Papers on Local Telecommunications Competition and Policy

Papers on Local Exchange Competition and Policy

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Why ADCO? Why Now? An Economic Exploration of Industry Structure for the "Last Mile" in Local Telecommunications Markets, Randy Beard, George Ford, and Larry Spiwak (published in the *Federal Communications Bar Journal*, 2002).

> This paper explains why the "transition to facilities" argument is meritless. The supply-side economics of local telecommunications prohibits a large number of facilities-based competitors. This is not true (to the same degree) on the retail side. Much like the current long-distance markets, where about 900 retailers are serviced over about 7 nationwide fiber networks, industry structure in the local market must bifurcate into a retail and wholesale segment for real competition to exist. Unbundling allows CLECs to acquire market share, which then serves as a non-ILEC demand for local exchange network. Without unbundling, there is not demand for alternative networks – consumers don't demand network, carriers do. Without available and effective demand, the costs of constructing local network can never be recovered – as is evident in the collapse of the segment of CLEC industry which adopted a "built it and they will come" business plan. The prudent path, made possible by unbundling, to "build it after they come."

Facilities-Based Entry in Local Telecommunications: An Empirical Investigation, Randy Beard, George Ford, and Tom Koutsky.

> This paper shows, using econometrics, that the deployment of end-office switching by CLECs is not attenuated in markets where unbundled switching prices are low. Instead, CLEC deployment of switches is actually higher in markets with low switching rates. A theoretical model explains the possible relationships between deployment and unbundling, and the theory provides no unambiguous conclusions (low switching rates may increase or decrease CLEC switch deployment). Thus, the issue is plainly empirical. The empirics show that low switching rates increase deployment. In markets where access to unbundled switching is restricted, there are fewer CLEC switched deployed.

Make-or-Buy? Unbundled Elements as Substitutes for Competitive Facilities in the Local Exchange Network, Randy Beard (Auburn University) and George Ford, PHOENIX CENTER POLICY PAPER NO. 14 (September 2002).

> The amount of CLEC entry using unbundled elements is highly sensitive to the price for such elements. A 10% increase in the price of an unbundled loop or switching reduces CLEC lines by more than 10% (i.e., the demand for UNEs is *elastic*). The cross-price elasticity between loops purchased with and without switching is zero. Thus, UNE-Platform does not reduce the demand for UNE-Loop (as the BOCs claim). From an antitrust perspective, the findings in this paper indicate that UNE-Loop and UNE-Platform service different markets. The paper also includes a statistical test of impairment with respect to switching, and finds that impairment exists.

A Fox in the Hen House: An Evaluation of Bell Company Proposals to Eliminate their Monopoly Position in Local Telecommunications Markets, PHOENIX CENTER POLICY PAPER NO. 15 (September 2002).

Between UNE-P, UNE-L, and full facilities-based entry, the BOCs' revenues are greatest with UNE-P. The other forms of entry leave BOC network stranded. Why then, do the BOCs prefer facilities-based competition? The answer is obvious. While the BOCs may lose more profit on a per-line basis from facilities-based entry, there is considerably less of it. By slowing competitive growth to a trickle, the total loss in margin is trivial. UNE-P, alternately, allows for the rapid growth of competition, and while BOC margin loss is less, the total margin loss is greater.

What Determines Wholesale Prices for Network Elements in Telephony? An Econometric Evaluation, George Ford and Randy Beard (Auburn University), PHOENIX CENTER POLICY PAPER NO. 16 (September 2002).

The BOCs' claim that state commissions have failed to base element rates on forward-looking cost (as required by the FCC's TELRIC standard) is evaluated econometrically. In contrast to the BOCs' assertions, forward-looking economic cost is the primary determinant of wholesale prices for network elements. Retail prices play no direct role in determining wholesale prices for UNEs. However, the state commissions have, according to the statistical model, set wholesale prices above forward-looking costs to provide the BOCs about half of their existing retail margins. While so, forward-looking costs are, by far, the more important determinant of wholesale prices for UNEs. Mr. Seidenberg was wrong – the state commissions 'do get it.'

Unbundling and Facilities-Based Entry by CLECs: Two Empirical Tests, by George S. Ford, Ph.D. and Michael D. Pelcovits, Ph.D. (former MCI Chief Economist, now with the consulting firm MICRA).

The number of lines served on CLEC-only facilities (i.e., pure facilities based) is positively related to market size and market density, and negatively related to the price of unbundled loops and unbundled switching. In an alternative test, the authors find that RCN's entry is negatively related to the price of unbundled loops. Thus, there is no evidence that there is more facilities-based entry where UNE rates are higher. In fact, the opposite is true.

Preliminary Evidence on the Demand for Unbundled Elements, Robert Ekelund, Jr. and George Ford (forthcoming in *Atlantic Economic Journal*, December 2002).

This paper estimates the demand elasticity for UNE-Platform. The paper finds that a 10% increase in the price of UNE-P elements reduces quantity of UNE-P sold by 27%. Thus, it is little surprise that the BOCs are now attacking the price of UNE-P elements, as well as availability.

Innovation, Investment, and Unbundling: An Empirical Update, Robert B. Ekelund, Jr. and George Ford (forthcoming in the *Yale Journal on Regulation*, Spring 2003).

In an article in the Yale Journal on Regulation, Bell advocates Thomas Jorde, Gregory Sidak, and David Teece (JST) commented on some potential economic consequences of the Telecommunications Act of 1996 as implemented by the Federal Communications Commission, and offered one interesting and testable proposition. Specifically, JST propose that mandatory unbundling increases the riskiness and cyclicality of the ILEC's [Incumbent Local Exchange Carriers] economic performance and, hence, on the ILEC's weighted-average cost of capital. This hypothesis is tested empirically using standard procedures. We find no evidence supporting the hypothesis of JST regarding the ILECs' cost of equity capital.

Why ADCo? Why Now?

An Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets

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I. INTRODUCTION

It is now more than five years since the passage of the landmark Telecommunications Act of 1996 (1996 Act), but instead of flourishing competition, the competitive local carrier sector has experienced a financial

1. T. Randolph Beard et al., *Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets* (Phoenix Ctr. Policy Paper No. 12, Nov. 2001), *available at* http://www.phoenix-center.org/pcpp/PCPP12.pdf.

meltdown.[2] So, what happened?

Basically, the issue can be narrowed to several fundamental misconceptions about the underlying economics of the telecommunications business by all of the major stakeholders, including Wall Street, policymakers, and would-be entrepreneurs. Namely, it appeared that everybody believed that: (a) entry into the local market would be relatively inexpensive; (b) the market immediately would be capable of sustaining multiple local access networks; and (c) as a result of their desire to enter the long-distance business, incumbents would gladly embrace competitive entry.[3]

As this paper will discuss, however: (a) entry into the local sector is an extremely *expensive* business, requiring firms to incur huge sunk costs and achieve scale economies quickly; (b) under current and foreseeable market conditions, local markets will only be able to sustain a few "last-mile" access networks (i.e., high concentration); and (c) incumbents were prepared to—and in fact did—go to great lengths in order to deter entry.[4]

As such, just as it was prior to 1996, one of the key unresolved issues in telecommunications restructuring continues to be the proverbial "last mile"[5]—that is, the last segment of the network necessary to connect the customer.[6] Indeed, despite the somewhat regular deployment of state-of-the-art national and regional long-haul networks and metropolitan fiber rings by a number of carriers, the deployment of alternative networks comes to a screeching halt when it reaches into the local exchange, leaving dominant control of most switching and transport facilities, and particularly

2. For example, according to Webmergers.com at least 750 Internet companies folded from January 2000 through December 2001. Moreover, in 2001 alone, 113 infrastructure providers went out of business (up from 17 for all of 2000), and 207 access providers went out of business (up from 19 for all of 2000). *Year End Shutdowns Rpt.: Shutdowns More Than Doubled in 2001*, WEBMERGERS.COM, *at* http://www.webmergers.com/editorial/article.php?id 49 (last visited Jan. 22, 2002). Unfortunately, however, it does not look like things are going to improve any time soon. *See, e.g.*, Ann Davis, *Upstart Phone Companies Find Competition Just Got Grimmer*, WALL ST. J. EUROPE, Oct. 1, 2001, at 24.

3. *See, e.g.*, Allan Sloan, *Dumb Deals 101*, NEWSWEEK, Sept. 10, 2001, at 38-41.

4. Unfortunately, public policies did little to help the process either. *See generally* MARK NAFTEL & LAWRENCE J. SPIWAK, THE TELECOMMUNICATIONS TRADE WAR: THE UNITED STATES, THE EUROPEAN UNION AND THE WORLD TRADE ORGANISATION (2000). Whether there will be any significant improvements remains to be seen. *See, e.g.*, Peter S. Goodman, *FCC Sitting Out Telecom War*, WASH. POST, May 3, 2001, at E1, E9.

5. While the "last mile" of the local exchange network is perhaps the most challenging trial for competition policy, the supply-side economics of many other components of the local exchange network, including switching and transport, also prohibit large-numbers competition.

6. The "last mile" is a term of reference and is not meant to describe a "measured mile." Instead, the "last mile" can be as small as a few feet or yards.

the "last mile" or "last yard" of the local exchange network, to the incumbent local exchange carrier ("ILEC").[7] In order to bypass the economic bottleneck for local access, therefore, the competitive local exchange carrier ("CLEC") industry has been faced with the core question of transaction cost economics: is it more efficient to buy local access via unbundling, special access, and so forth from the reluctant incumbent, and conduct their transactions in the market, or build their own local access network from scratch, and bring the transaction out of the market and into the firm?[8] Unfortunately, the problem is that under current and foreseeable market conditions, neither option is particularly economically appealing.

On the one hand, given the incumbents' near-complete dominance of the local access market, there really is no competitive "market" where a firm can purchase local access at just and reasonable rates that will be provisioned on a timely basis. Acquiring needed inputs (i.e., elements) from the incumbents at just and reasonable rates and provisioning intervals is no cake walk either. After all, dominant firms do not typically facilitate *the demise of their dominance*. This is not an irrational concept, because *no firm will ever be enthusiastic about consciously going against its own self-interests by selling its rivals their key input of production* (i.e., loops).[9] Indeed, while the 1996 Act requires the ILECs to provide such elements, the Act did little to fundamentally alter economic incentives.[10] So long as this inherent wholesale-supplier/retail-competitor conflict exists between an ILEC and a CLEC, then the ILECs' ability to manipulate prices for

7. *See, e.g.*, Rebecca Blumenstein, *Telecom Act Hasn't Delivered Promised Price Relief*, WALL ST. J., May 3, 2001, at B1, B4.

8. *See, e.g.*, OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM (Free Press 1985).

9. *But c.f.* Edie Herman, *FCC Targets Mid-December for Start of UNE Review*, COMM. DAILY, Nov. 30, 2001, at 3 (reporting FCC Common Carrier Bureau Chief Dorothy Attwood's comments at a conference sponsored by the Association of Local Telecommunication Services ("ALTS")). According to Herman:

> Attwood said "no one disputes" those complaints [against the RBOCs' wholesale practices] but she urged audience to listen to call[s] . . . for ILECs and CLECs to try to work together to resolve disputes over UNE provisioning before they escalated to FCC or state regulators. *When [an] audience of competitive business people groaned, Attwood said that wasn't [a] bad idea because ILECs knew they couldn't throw out their statutory requirements so they appeared to be willing to cooperate more. "I think it's in the interests of incumbents to be an efficient wholesaler," she said.*

Id. (emphasis added).

10. Unfortunately, the defense of many CLECs to the current financial collapse is that it was not unreasonable for them to base a business plan on a federal law, enacted by Congress, signed by the president, and upheld as constitutional by the courts, that guarantees them the right to unbundled network elements. While this may be true, this is a *legal* argument not an economic one.

elements and to control quality leaves sufficient room for ILECs to sabotage transactions, defined as the ability to increase the cost of a rival's key input of production by nonprice behavior between itself and CLECs.[11]

On the other hand, as the relative paucity of alternative local networks and rampant bankruptcy in the CLEC industry demonstrates, the economics of self-supply are not particularly compelling either. As explained below, telecommunications is an extremely expensive business, and many CLECs are discovering to their dismay and chagrin that they cannot achieve sufficient economies of scale, scope, or density to warrant the capital required to build various components, even relatively small components, of the local exchange network from the ground up. The large sunk costs required to construct local exchange networks greatly increase the risk of entry and severely limit the number of financially viable alternative "last-mile" networks in most local markets.[12] *Simply put, the supply-side economies of the local exchange market prohibit competition among large numbers of network-based firms.* The hope for large-numbers competition among network-based firms under current and foreseeable market conditions is sheer fantasy.[13]

Accordingly, the tenuous relationship between a reluctant wholesale ILEC supplier and its retail competitor-consumer CLECs, as well as the substantial scale economies and sunk costs required to participate in the local exchange market, suggest that neither of the two alternatives for facilitating competition offer substantial promise as a long-term solution to monopoly in the local exchange marketplace. So, what to do? How do we go from "one" firm to "many" firms in an economically efficient manner—the *raison d'être* of market "restructuring"? *This Article will explore the*

11. The definition of the term "sabotage" articulated *supra* originates in T. Randolph Beard et al., *Regulation, Vertical Integration and Sabotage*, 49 J. INDUS. ECON. 319 (2001), and will be used *passim*. For a full explanation of the sabotage concept, *see* Section IV.D *infra*.

12. Limitations on the number of viable firms are not restricted to the "last mile." Rather, any segment of the network characterized by sunk costs and scale economies has limited opportunities for successful entry. For a thorough discussion of the effects of sunk costs on entry and industry structure, *see* JOHN SUTTON, SUNK COST AND MARKET STRUCTURE: PRICE COMPETITION, ADVERTISING, AND THE EVOLUTION OF CONCENTRATION (1991). For a similar analysis applied to the communications industries, see Jerry B. Duvall & George S. Ford, *Changing Industry Structure: The Economics of Entry and Price Competition* (Phoenix Ctr. Policy Paper No. 10, Apr. 2001), *available at* http://www.phoenix-center.org/pcpp/PCPP10Final.pdf [hereinafter Policy Paper No. 10].

13. Federal Communications Commission Chairman Michael K. Powell, Address at the National Summit on Broadband Deployment (Oct. 25, 2001) *available at* http://ftp.fcc.gov/Speeches/Powell/2001/spmkp110.html; Ivan Seidenberg, Address at the Goldman Sachs Communacopia X Conference (Oct. 4, 2001) *at* http://www.verizonld.com/news/index.cfm?Article=114.

merits of an untapped market-based third option for local access: the alternative distribution company ("ADCo"), which essentially is a wholesale "carriers' carrier" for local network "last-mile" access.[14]

The "carriers' carrier" is not a new concept to telecommunications. Many long-haul networks, both national and regional, are built and/or operated as a "carriers' carrier." The economic forces that create a wholesale market in the long-distance industry, where about six nationwide and numerous regional networks support well over 500 retailers, are no less present in the local exchange.[15] Indeed, those economic forces—economies of scale, economies of density, and sunk costs—are even more important in the local exchange than in long-distance, where fiber deployment in metropolitan markets is about twelve times as expensive as long-haul fiber networks.[16] As such, the case for a "carriers' carrier" in the local exchange market at this stage of the telecommunications industry restructuring process is compelling.

More importantly, given its wholesale entry strategy, the ADCo provides for new entrants a viable economic solution to the problems raised by *the inherent incentive of an incumbent unduly to discriminate to protect* its profits. This issue of incentives is key to understanding the current ills of the market, as it is now clear that policymakers significantly underestimated the significant incentives of the incumbents to unduly discriminate against their rivals, not to mention also underestimating the entry costs of the local market. In fact, it is becoming readily apparent that, given the current and foreseeable underlying economics of the industry, no amount of regulation—with perhaps the exception of total structural separation—can ever fully mitigate the cross-incentives of the incumbents' wholesale-supplier/retail-competitor relationships with CLECs.

To explore the merits of the ADCo in detail, this Article, using an analysis first set forth in Phoenix Center Policy Paper No. 10,[17] will briefly

14. An "ADCo" is a very different concept from a "LoopCo." A "LoopCo" is formed by the structural separation of the incumbent's local access network facilities from the incumbent's marketing operations. *See, e.g.*, Roy L. Morris, *A Proposal to Promote Telephone Competition: The LoopCo Plan*, *available at* http://hometown.aol.com/RoyM11/LoopCo/index.html (last visited Jan. 22, 2002); Maev Sullivan, *Loop Co Is the Only Game in Town*, COMM. WEEKLY INT'L, July 16, 2001. An ADCo, however, is the entry of a completely new firm that contemplates an exclusive wholesale entry strategy for local access from the outset.

15. *See Trends in Telephone Service*, Industry Analysis Division, FCC Common Carrier Bureau, 10-12 tbl.10.6 (2000), *available at* http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/trend200.pdf.

16. Dan Sweeney, *City of Lights – The Pricing of Fiber Build-outs: A Special Report*, COMPETITIVE CARRIER, Aug. 1, 2001, at 6, 7.

17. *See* Policy Paper No. 10, *supra* note 12.

explain that given the underlying economics of the market, and that much of the entry costs of a telecommunications network are sunk, industry concentration in telecommunications markets is expected to be relatively high.[18] Accordingly, expecting a large number of competitors in local access markets—particularly a large number of network-based competitors—is entirely unreasonable.[19]

Second, this Article will evaluate in a summary fashion the two primary forms of entry observed since the passage of the 1996 Act:

Option 1: Element-Dependent Entry ("EDE"): An entry strategy where the new entrant relies heavily on the elements of a reluctant incumbent, rather than build its own network, and purchases local access from the incumbent via special access lines, high-capacity circuits (T1's), full resale, individual unbundled network elements ("UNE"), or even the entire UNE platform ("UNE-P"—a combination of the local loop, unbundled switching, and transport elements). This form of entry includes those entrants relying on the elements of the incumbent until their own networks are deployed (i.e., a "smart-build" strategy). As these firms must also sink huge amounts of capital in equipment to enter, however, these firms are certainly "facilities-based" entrants, albeit not "network-dependent" entrants as discussed in the next paragraph.

Option 2: Network-Based Entry ("NBE"): A strategy where a CLEC seeks to build its own local access network from scratch with little or no reliance on the incumbent's network.

Third, this Article will explore the full impact of the incumbents' incentive to frustrate competitive entry by setting forth a simple economic model that analyzes the incentives of a vertically integrated supplier—one

18. *See also* T. Randolph Beard & George S. Ford, *Competition in Local and Long-Distance Telecommunications Markets*, *in* THE INTERNATIONAL HANDBOOK OF TELECOMMUNICATIONS ECONOMICS (Gary Madden & Scott J. Savage eds., forthcoming 2002).

19. Given the geographic specificity of a telecommunications plant, it is possible for many firms to produce telecommunications services. However, very few firms actually will compete in the same geographic area. For example, there are many cable television firms, but nearly every cable system is a monopoly.

that operates in both the upstream wholesale market and in the downstream retail market—to provide inputs of production to actual or potential competitors. For consistency with the reality of building a local exchange plant, this model assumes that there are economies of scale or density in the downstream retail market.[20] Also assumed for modeling purposes is that services are profitably supplied. As the model reveals, *the incentives to supply the "upstream" or "wholesale" market at cost-based prices, thus facilitating competition in the "downstream" or "retail" market, are inversely related to the market share of the firm in the retail market—irrespective of whether the firm is an ILEC or a CLEC*, though the CLEC has no incentive to sabotage its customers. The model illustrates that there is a fundamental tension between the benefits of large scale, wholesale operation, and the disincentives that firms with large retail operations have to "share" those wholesale benefits with retail competitors through the efficient sales of network facilities.

Finally, this Article uses the model to compare the incentives of the vertically integrated suppliers to those of wholesale-only suppliers (ADCos). As explained below, *given the existence of the ILECs' discriminatory incentives resulting from the current and foreseeable economic conditions of the U.S. telecommunications industry, the model suggests that the most probable and viable long-term, competitive market structure involves a substantial presence by an unintegrated, but larger wholesale supplier*[21]*—in other words, an ADCo—to function efficiently.* Accordingly, their presence in the market should be welcomed and encouraged.

II. BASIC ISSUES OF INDUSTRY STRUCTURE AND ENTRY

A. *Introduction*

Elementary economic analysis can shed considerable light on the long-run structure of the U.S. telecommunications industry, an issue of

20. The model assumes that either economies of scale or density exists, but the term "economies of scale" is used throughout this paper. "Economies of scale" describes the relationship between costs and firm/network size. "Economies of density" describes the relationship of costs and output for a firm/network of a fixed size. Either interpretation of the relationship of cost and size/output is consistent with the analysis of this paper.

21. By "large" we mean large enough to achieve sufficient economies of scale for the market being served. While our focus is generally on the last mile or last yard, economies of scale can be substantial in other areas. For example, the systems and electronic interfaces required for a CLEC to transact successfully with an ILEC may be subject to scale economies. If true, then this "provisioning" interface may be best provided on a wholesale basis.

enormous importance. The role of competition policy is to create an environment in which feasible long-term arrangements—those that are consistent with robust, commercially successful local competition—can take place. One example of such analysis is provided in *Changing Industry Structure: The Economics of Entry and Price Competition*.[22] In this policy paper, Drs. Duvall and Ford show that the equilibrium level of concentration in telecommunications markets will be relatively high. *The presence of sunk costs, in any industry, limits the number of firms that can profitably serve a market. The larger sunk costs are relative to market size, the higher the equilibrium level of concentration.*

More formally, Duvall and Ford show theoretically that the equilibrium number of firms in a market (N^*) is the integer part of:

$$N^* = \sqrt{\frac{\phi M}{\kappa}} \quad (1)$$

where ϕ is an index of the intensity of price competition ($\phi \geq 0$, where $\phi = 0$ for Bertrand, or highly intense, price competition, and $\phi = 1$ for Cournot competition in quantities), M is market size, κ measures the sunk entry costs, and $1/N^*$ is the equilibrium level of industry concentration and is equal to the Herfindahl-Hirschman Index ("HHI") under the assumption of identical firms.[23] Put simply, the number of firms supplying a market is positively related to the size of the market (M), but inversely related to the intensity of price competition (ϕ) and the sunk costs of entry (κ). *The larger are fixed/sunk costs, other things constant, the fewer the firms that can profitably supply the market and the higher is equilibrium industry concentration. Likewise, the more intense the price competition, the higher the industry concentration.*[24]

The inability of local telecommunications markets to support high levels of competition can be illustrated by example. Telecommunications firm RCN targets residential customers in densely populated markets with its own network facilities, over which it provides telephone, data, and video services.[25] According to its financial documents, RCN has $2.75 billion in

22. Policy Paper No. 10, *supra* note 12.

23. The models assume all firms are identical. The HHI, the sum of the squared market shares of relevant firms, is a commonly used measure of industry concentration.

24. Generally, price competition is expected to be weakest in highly concentrated markets. When entry requires sunk costs, however, this expectation can be invalid.

25. According to RCN's 10-Q Form, about 12% of RCN's phone customers are "off-net," supplied over the ILEC's network via resale. RCN CORP., 2001 THIRD QUARTER FORM 10-Q (Nov. 9, 2001), *available at* http://www.rcn.com/investor/index.html.

plant and passes about 1.5 million homes, or 1.1 million marketable homes.[26] Plant investment runs about $1,750 per home passed, $2,500 per marketable home, or about $6,500 per customer.[27] A rough estimate of RCN's monthly plant costs (assuming a 15% hurdle rate and 15-year payoff) is about $25 per home passed. Average monthly revenue per subscriber is about $130 and direct costs are about 46% of revenues, implying a gross monthly margin of about $68 per subscriber. In order to cover plant costs with its net revenues, RCN needs a penetration rate of about 35% to 40%, and that is in the more densely populated markets targeted by RCN over a network capable of generating services worth $130 per subscriber. *Notably, if a 35% to 40% penetration rate is required for profitability, then only two firms can profitably service the same market, and RCN and the incumbent make two.*[28] To construct an RCN-style network for every household in the United States, the plant investment and total entry costs would be about $300 billion and $600 billion, respectively.[29] Clearly, network-based entry is incredibly costly and is not something that is replicable by numerous firms in the same market.

Similarly, the metropolitan fiber rings and spurs needed to provide service to large businesses are incredibly costly as well. Some fiber companies estimate that fiber deployment in a metropolitan area routinely costs $3 million per mile.[30] Thus, construction of a large metro ring or mesh could easily exceed $100 million.[31] Further, most if not all of these costs are sunk; roughly half of the costs of metropolitan fiber are installation expenses.[32] The services provided over metropolitan fiber networks vary, as

26. RCN CORP., 2000 ANNUAL REPORT (2001), *available at* http://www.rcn.com/investor/index.html. Marketable homes are those homes that RCN's network can immediately serve.

27. Values are based on RCN's 1998, 1999, and 2000 Annual Reports. For example, between 1999 and 2000, RCN's Plant and Property grew by $1.5 billion while its marketable homes grew by about 550,000. In 1999, RCN's penetration rate into marketable homes was about 40%. *Id.*; *see also* RCN CORP., 1999 ANNUAL REPORT (2000), *available at* http://www.rcn.com/investor/index.html; RCN CORP., 1998 ANNUAL REPORT (1999), *available at* http://www.rcn.com/investor/index.html.

28. With a reasonable guess of the minimum penetration a firm needs to cover its costs, the number of firms that can operate in a market is the integer part of the inverse of the minimum penetration (e.g., 1/0.40 = 2.5).

29. These investment estimates are rough. Plant investment is estimated by assuming the cost differentials and population distributions across density zones are similar to those estimated by the HAI Model (v. 2.2.2), a total element long-run incremental cost model developed by HAI and Associates, AT&T, and MCI-WorldCom. RCN's current network is assumed to be deployed in the two most dense zones. Nonplant entry costs are assumed to be about $1 for every $1 of plant (see Table 1 *supra*).

30. The costs of any particular installation vary widely. *See* Sweeney, *supra* note 16.

31. *Id.* at 6.

32. *Id.* at 7, 9.

do the size and scope of these networks. Thus, simple profitability models like the RCN example are difficult to construct. However, the fact that less than 10% of buildings have fiber drops suggests that the sunk costs in the network are sizeable relative to market size.[33]

The implication of the economic theory is clear: *the number of firms supplying a market is not unbounded when there are sunk costs.* Given that much of the entry cost of a telecommunications network is sunk and large relative to market size, *industry concentration in telecommunications markets is expected to be relatively high*—in other words, there will be few firms in the market. Indeed, until recently, the presumption was that the local exchange market was a natural monopoly (i.e., $N^* = 1$). While the technology and law governing the telecommunications industry has changed, these changes have not totally altered the supply-side economics of the industry. *Large-numbers competition among network-based local exchange carriers is forbidden by the supply-side economics of the industry.*

B. Sunk Costs and the Necessity of Achieving Sufficient Economies of Scale and Scope

The fact that economies of scale (or density) and sunk costs play a key role in telecommunications network deployment goes without saying. In order to achieve profitability in a reasonable time frame, therefore, the large fixed costs of the plant must be averaged out over a large quantity of services that are sold relatively quickly. Ignoring this reality has put many a CLEC into bankruptcy.

An important misconception policymakers and Wall Street have about the telecommunications industry is that entry into telecommunications is somehow limited to just the cost of network construction and architecture. Quite to the contrary, entry into the telecommunications business requires the additional commitment of tremendous fixed and sunk costs to cover the costs of billing systems, regulatory efforts and responses, pre-positive cash flow, general administrative costs, and, perhaps most significant of all, customer acquisition and retention costs.

For example, Douglas Galbi estimates AT&T's annual marketing expenses to be approximately $2 billion per year from 1994 through 1997.[34] Galbi also provides evidence that marketing expenses in the long-distance industry are subject to economies of scale. Other sources indicate that

33. *Id.* at 9. *See also* Yuki Noguchi, *CityNet Wins $275 Million in Funding*, Washtech.com, Apr. 10, 2001, *at* http://www.washtech.com/news/telecom/8919-1.html.

34. Douglas A. Galbi, Some Costs of Competition 5 (Jan. 24, 1999) (unpublished manuscript, on file with Journal), *available at* http://www.galbithink.org.

acquisition costs for residential local or long-distance customers are about $150 per customer, virtually all of which is sunk.[35] For larger business customers and buildings, where the stakes and margins are relatively high, the acquisition costs are expected to be sizeable.[36]

Similarly, regulatory costs are nontrivial entry investments. Industry experts estimate that approximately 10% of the entry costs for metropolitan fiber rings and spurs are related to obtaining government approval. In some cases, "[d]eliberations involving local government entities, public utilities and private claimants can extend well beyond a year, and in some cases may never reach a successful conclusion, aborting the project before a single fiber can be buried."[37] Clearly, approval costs incurred for a project later abandoned have little or no value and are thus sunk. As noted *supra*, the average cost of a mile of fiber deployed in a metropolitan market is estimated by some to be $3 million, the sunk costs related to regulatory approval are nontrivial and may represent a formidable entry barrier.[38]

Accordingly, the magnitude of nonplant entry costs is sizeable. Table 1 illustrates the proportion of facilities' investment (measured as *net plant*) to total entry costs for a sample of CLECs. Entry costs are measured as the spent portion of capital invested in the firm including debt and equity.[39]

35. *See For Whom, the Bells' Toll?*, Bernstein Research, Feb. 1997, at 55-56; *see also* Press Release, Juno Online Services, Inc., Juno Online Services, Inc. Reports Record Third Quarter Results (Oct. 27, 1999), *available at* http://www.itconnect.com/uatd/pages/news_releases.shtml?d=20258.

36. *See, e.g.*, Declaration of A. Daniel Kelley and Richard A. Chandler, HAI Consulting, Inc., WorldCom Comments, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket No. 96-98, Attachment D (June 11, 2001), *available at* http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6512660125; Brief of AT&T Corp., Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket No. 96-98, Exhibit 1 (June 11, 2001), *available at* http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6512660142.

37. Sweeney, *supra* note 16 at 9.

38. *See id.*

39. Entry cost is measured by total long-term debt, other liabilities, and equity investments, minus cash and short-term investments. Plant is measured as net plant. All figures compiled from company 10-Q forms for the second quarter of 2001. XO COMM., INC., 2001 SECOND QUARTER FORM 10-Q (Aug. 13, 2001), *available at* http://www.xo.com/investors/financials/quarterlyearnings/XO2001_Q2_Financials.pdf; ALLEGIANCE TELECOM, INC., 2001 SECOND QUARTER FORM 10-Q (Aug. 13, 2001), *available at* http://www.allegiancetelecom.com/pdf/2q_10q_2001.pdf; RCN CORP., 2001 SECOND QUARTER FORM 10-Q (Aug. 14, 2001), *available at* http://www.rcn.com/investor/press/index.html; COVAD COMMS. GROUP, INC., 2001 SECOND QUARTER FORM 10-Q (Aug. 20, 2001), *available at* http://www.covad.com/companyinfo/investorrelations/documents/COVD-10-Q-08-20-2001.PDF; MCLEOD, 2001 SECOND QUARTER FORM 10-Q (Aug. 14, 2001), *available at http://www.sec.gov/Archives/edgar/data/919943/000092838500002228/0000928385-00-002228.txt*; TALK AMERICA (formerly Talk.Com), 2001 SECOND QUARTER

Table 1. Entry Costs and Plant

	Entry Costs (E) (in thousands)	Net Plant (P) (in thousands)	E/P	P/E
XO	$10,739	$3,505	$3.06	34%
Allegiance	$2,083	$939	$2.22	45%
RCN	$4,859	$2,331	$2.08	48%
Covad	$2,414	$294	$8.20	12%
McLeod	$8,260	$3,220	$2.57	39%
Talk America	$429	$80	$5.37	19%
Northpoint	$1,041	$455	$2.29	44%
ITC^Deltacom	$1,036	$708	$1.46	68%
US LEC	$369	$191	$1.93	52%
Wgt. Average			*$3.06*	*38%*

As the table illustrates, investment in plant is typically a very small proportion of total dollars invested. As Table 1 further demonstrates, the ratios of expense costs to plant costs range significantly from ITC's relatively low ratio of 1.5:1 to Covad's ratio of 8:1. On average, however, net plant amounts to about 38%, approximately one-third of total entry costs for this sample. *In other words, for every dollar of investment in plant and equipment, an additional $2 of entry costs are incurred on average.* There is no reason to suspect that these additional entry costs are less sunk than plant and equipment, but there is good reason to believe such costs are more sunk.[40]

When considering the prospects and sustainability of competitive entry in telecommunications markets, therefore, economies of scale and sunk costs cannot be ignored. Nor can the focus on such economies and sunk costs be limited to network investment. Indeed, as revealed in the following Sections, the extent of scale economies is an important determinant not only in the level of industry concentration, but also in the type of firms that exist in equilibrium. As the model explains *infra*, size matters, but in conflicting ways.

FORM 10-Q (Aug. 14, 2001), *available at* http://www.talk.com/; NORTHPOINT, 2001 SECOND QUARTER FORM 10-Q (Aug. 14, 2001), *available at* http://www.sec.gov/Archives/edgar/data/1080558/000092962400001175/0000929624-00-001175.txt; ITC^DELTACOM, INC., 2001 SECOND QUARTER FORM 10-Q (Aug. 14, 2001), *available at* http://www.sec.gov/Archives/edgar/data/1041954/000092838501501525/ d10q.txt; US LEC CORP., 2001 SECOND QUARTER FORM 10-Q (Aug. 6, 2001), *available at* http://www.sec.gov/ Archives /edgar/data/1054290/000101706201500698/d10q.txt.

40. Plant and equipment can at least be sold in some instances.

C. *Unbundling and the Necessity of Creating Sufficient Nonincumbent Demand*

One of the centerpieces of the 1996 Act is the unbundling obligation imposed on the ILECs.[41] The original idea behind unbundling is that because there are high entry barriers into the local access market . . . unbundling—i.e., a weak form of divestiture—would permit new firms to "leapfrog" those barriers to accelerate the pace of competition. In its most simple form, unbundling should lead to new network-based competition by providing new entrants initially with the appearance of "ubiquity" and economies of scope necessary to enter a very costly business—i.e., the entrant would first develop its customer base, and (because it has no desire to purchase its primary inputs of production from its rivals) would then build-out as conditions warrant. Such a strategy is often referred to as a "smart-build" approach. This is precisely what the FCC did in its 1980 MTS/WATS Resale Decision to great success for the U.S. long-distance market.[42]

While the development of competition in the interexchange industry provides important insights, it is crucial to understand that the scale and/or density economies in the local market are more significant than in long-haul networks. Consequently, it is unclear whether individual firms purchasing unbundled network elements will ever acquire sufficient market share to justify the construction of networks for their *exclusive* use. Without the ability to obtain alternative capacity, however, these firms' dependence on the recalcitrant incumbent will adversely affect their ability to succeed in the long run.

This is not to say that the unbundling provisions of the 1996 Act are a failure and should be eliminated. On the contrary, unbundling is critical to developing sufficient nonincumbent demand for new network-based facility investment to warrant the entry of an ADCo. That is to say, as demand for network elements becomes less concentrated (i.e., the ILEC does not serve all customers), the potential for rapid and large migrations of demand off the incumbent's network to an alternative network exists. While the dominant incumbent provider will rarely, if ever, demand the facilities of an alternative element supplier, the risk of entry by a competitor is considerable without existing demand for elements. (The proverbial "build it and they will come" proved successful in Hollywood, but not for CLECs.) Yet, if unbundling migrates substantial portions of

41. 47 U.S.C. § 251(c)(3) (Supp. V 2000).

42. *See* NAFTEL & SPIWAK, *supra* note 4, at 208. The term "smart build" has other meanings as well. In some contexts, for example, "smart build" refers to a slow, meticulous buildout strategy designed to maximize market potential with limited capital resources.

telecommunications demand to new entrants, then an ADCo can enter and consolidate (or aggregate) this new nonincumbent demand for network elements dispersed among the various firms who currently purchase UNEs from the incumbent, much like building a shopping center with your anchor tenants already secured. In so doing, network-based entry occurs both in the form of new alternative network construction, and in terms of new technology investment (e.g., interconnecting a sophisticated database to the incumbents' advanced intelligent network ("AIN")) to permit advanced managed-IP products and services. Large-numbers competition occurs at the retail and application level, whereas small-numbers competition occurs at the wholesale or network level. This arrangement is most compatible with the underlying economics of the telecommunications industry.

III. THE CURRENT SITUATION: ENTRY AFTER THE 1996 ACT

In this Section, this Article examines two primary forms of CLEC entry strategy observed since the passage of the 1996 Act. Entry strategies are varied, so it is difficult to classify CLECs into broad categories. However, there appear to be two very different entry modes at a high level of generality in use: entrants that depend heavily on ILEC facilities, and those that do not. While these entry strategies are apparently quite different, similarities exist between the two. Nearly all entrants, for example, must deal with the ILEC in some way.

A. *Element-Dependent Entrants: The "Buyers"*

First, there are those entrants that rely heavily on the elements of the ILEC (the dominant incumbent, integrated supplier) called element-dependent entrants ("EDEs"). This group of entrants ranges from those using total service resale to those combining ILECs' local distribution plant, from local loops to high capacity circuits, with self-supplied elements. DSL providers, for example, rely on ILEC loops and collocation space. Switch-based entrants also rely almost exclusively on ILEC loop plant and provisioning labor, such as hot-cuts, which is combined with self-supplied switching. UNE-P, or the combination of loops, local switching, and transport, is an element-dependent entry strategy that relies heavily on ILEC elements. In some cases, however, the UNE-P CLECs integrate their own technology into the platform to customize the service.[43] In fact, with the exception of total service resale, virtually all EDEs integrate some type

43. For example, Z-Tel Communications integrates a variety of call control features, Internet functionality, and voicemail with the UNE-P. Z TEL TECHNOLOGIES, INC., 2000 Annual FORM 10-K (Mar. 28, 2000), *available at* http://www.tenkwizard.com/files.php?sym=ZTEL&repo=tenk&ind=-1&st=2&&page=2&extras=0.

of facilities with the ILEC network. Thus, as noted above, while EDEs may not be new "network" facilities-based entrants, they should nonetheless be considered to be facilities-based entrants.

A problem faced by all EDEs is the ILECs' incentive to impede new entry, and examples of these incentives in action are readily available.[44]

44. *See, e.g.*, Yuki Noguchi, *CLECs Blame Bells, Bells Blame Hookups, Some Blame Agencies*, WASH. POST, Dec. 16, 2000, at E1; Peter S. Goodman, *FCC Chief Stresses Phone Competition*, WASH. POST, May 8, 2001, at E1. Indeed, the incumbents are keeping the FCC's Enforcement Bureau busier than ever. For example:

- On September 14, 2001, the FCC's Enforcement Bureau announced that it entered into a *Consent Decree* with Verizon Communications, Inc. ("Verizon"), under which Verizon will make a "voluntary payment" of $77,000 to the U.S. Treasury and will take certain remedial actions regarding its collocation practices. Verizon Comms., Inc., *Order*, 16 F.C.C.R. 16270 (Sept. 14, 2001).

- On May 29, 2001, the FCC affirmed the $88,000 fine imposed by the Commission's Enforcement Bureau in March 2001 against SBC Communications, Inc. ("SBC") for violating reporting requirements that the Commission imposed pursuant to its approval of the merger application of SBC and Ameritech. SBC Comms., Inc., Apparent Liability for Forfeiture, *Order on Review*, 16 F.C.C.R. 12306, 23 Comm. Reg. (P & F) 1547 (May 29, 2001).

- Similarly, on January 18, 2001, the FCC sought to fine SBC $94,500 after an independent audit discovered that SBC failed to comply with the FCC's rules that require incumbent telephone companies to allow competing telephone companies to place equipment in the incumbents' offices: in particular, the Commission found that SBC failed to post promptly notices of all incumbent-owned sites that have run out of collocation space so competitors do not waste time and resources applying for collocation space where none exists. SBC Comms., Inc., Apparent Liability for Forfeiture, *Notice of Apparent Liability for Forfeiture*, 16 F.C.C.R. 1012 (Jan. 18, 2001).

- On November 2, 2000, the FCC settled with BellSouth Corporation to have them make a "voluntary payment" of $750,000 to the U.S. Treasury and to take important steps to improve its compliance with FCC rules relating to the negotiation of interconnection agreements between competing carriers. BellSouth Corp., *Order*, 15 F.C.C.R. 21756 (Nov. 2, 2000). Indeed, the FCC's investigation disclosed that, for more than six months in 1999, BellSouth failed to provide a competitor with cost data to support BellSouth's proposed prices for unbundled copper loops, despite the competitor's written request for such data. *Id.* para. 5. In addition to the $750,000 voluntary payment, the *Consent Decree* obligates BellSouth to adopt procedures for expedited access to confidential information, including issuance of a standard nondisclosure agreement that complies with the relevant FCC rules, and to adopt procedures for competitors to elevate disputes regarding disclosure of confidential information to higher levels within BellSouth. *Id.* paras. 13, 15. In addition, BellSouth will provide training to its negotiators concerning the relevant statutory and

Additionally, EDEs are subject somewhat to the whims of regulation. Past and potential regulatory failures, and the frequent capture of regulatory agencies by the ILECs, make element-dependent entry a somewhat risky endeavor.[45] Those risks, however, are at least partially offset by the decreased risk provided by the reduction in sunk cost investments. Because regulators can substantially impact the financial condition of EDEs, regulatory costs for EDEs can be substantial.[46]

Opportunities for sabotage of EDEs by regulators are always at hand. The FCC, for example, has shown a willingness to remove elements from the list of unbundled elements for less than compelling reasons.[47] For example, the FCC does not require that the ILEC provide unbundled local switching to CLECs whose customers have more than three access lines and are located within the densest markets. The basis for the FCC's switching exclusions was that a few CLECs had deployed switching equipment in some dense markets.[48] Notably, many of these switches were deployed by now-bankrupt CLECs, and much of that switching capacity

regulatory requirements, as well as BellSouth's revised procedure. *Id.* para. 14.

Notwithstanding these ostensible enforcement actions by the FCC (which are supposed to be one of the centerpieces of Chairman Michael Powell's agenda for the FCC), what is extremely important to recognize here is that these cases are the administrative equivalent of a "no contest" plea. Indeed, as there is no formal record kept of the proceeding and guilty parties are only required to make a "voluntary contribution to the U.S. Treasury" as part of the settlement, the FCC has very deliberately refused to make an explicit finding of fact. As a legal matter, therefore, these settlements have little or no probative weight in a subsequent criminal or civil court of law. Besides, if a firm perceives it will make one dollar more by deterrence than by competition, then that firm will *always* choose deterrence.

45. *See* Lawrence J. Spiwak, *The Four Horsemen of the Broadband Apocalypse*, COMM WEEK INT'L, April 1, 2002. For a more detailed exegesis of the FCC's regulatory failures of the last several years, see generally NATTEL & SPIWAK, *supra* note 5.

46. Despite the problems with element-dependent entry, the EDE entry strategy is today the most effective at providing consumer choice in local telecommunications. In fact, those EDEs with the greatest reliance on the ILEC are most successful in acquiring market share. Element-dependent strategies such as UNE-P allow for the rapid accumulation of market share without the need to sink costs in the network. The relative success of EDEs, particularly UNE-P CLECs, perhaps has reduced regulatory risks. In the regulatory arena, a customer base is a constituency, and UNE-P CLECs may have acquired sufficient market share to discourage regulatory sabotage of that particular entry strategy.

47. *See, e.g.*, Review of Reg. Requirements for Incumbent LEC Broadband Telecomm. Servs., *Notice of Proposed Rule Making*, CC Docket No. 01-337 (Dec. 20, 2001), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-01-360A1.pdf; Review of the 251 Unbundling Obligations of Incumbent Local Exchange Carriers, *Notice of Proposed Rule Making*, CC Docket No. 01-339 (Dec. 20, 2001), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-01-339A1.pdf.

48. Implementation of the Local Competition Provisions of the Telecomms. Act of 1996, *Third Report and Order and Fourth Further Notice of Proposed Rule Making*, 15 F.C.C.R. 3696, 18 Comm. Reg. (P & F) 888 (1999).

was not designed for the port-side services that substitute for unbundled switching. The switching exclusion is currently being reconsidered at the FCC, however. Further, the FCC is presently considering an effort by the ILECs to eliminate high-capacity circuits from the list of unbundled elements. Generally, high-capacity unbundled loops can be more than half as costly as equivalent special access service purchased out of ILEC retail tariffs. Thus, the ILECs' desire to remove high-capacity circuits from the list of unbundled elements is apparent. And, the FCC's review of section 271 applications to permit ILECs to vertically reintegrate and to provide in-region interLATA service appears now to be little more than a formality, with approval a near-guarantee.[49]

While excluding particular elements from the list of unbundled elements certainly interferes with their purchase, high prices for elements can be an equally effective deterrent to entry. Important to the purchase of the ILECs' elements is that the price of these elements is supposedly set equal to total element long run incremental costs ("TELRIC").[50] ILECs strongly oppose TELRIC pricing, and the pricing standard has been challenged in court since its conception in the FCC's *First Report and Order* implementing section 251 of the 1996 Act.[51] Generally, the ILECs oppose TELRIC pricing because the prices for elements are alleged to be confiscatory (i.e., are "too low" or "below costs") and therefore somehow result in unlawful "takings."[52]

49. *See* NATTEL & SPIWAK, *supra* note 4, at 226-31.

50. TELRIC is a method of determining the cost of telephone service based on the forward-looking incremental cost of equipment and labor without taking into account the historical, or embedded, cost. The pricing method is based on a hypothetical network using the most efficient technology available. *See* 47 C.F.R. §§ 51.503, 51.505 (2000); Implementation of the Local Competition Provisions in the Telecomms. Act of 1996, *First Report and Order*, 11 F.C.C.R. 15499, 4 Comm. Reg. (P & F) 1 (1996) [hereinafter *First Report and Order*], *vacated by* Iowa Utils. Bd. v. FCC, 120 F.3d 753 (8th Cir. 1997), *remanded by* Iowa Utils. Bd. v. FCC, 219 F.3d 744 (8th Cir. 2000), *cert. granted*, Gen. Comms., Inc. v. Iowa Utils. Bd., 531 U.S. 1124 (2001).

51. *First Report and Order*, *supra* note 50, paras. 555-607, *aff'd in part and vacated in part sub nom.* Competitive Telecomms. Ass'n v. FCC, 117 F.3d 1068 (8th Cir. 1997) and Iowa Utils. Bd. v. FCC, 120 F.3d 753 (8th Cir. 1997), *aff'd in part, rev'd in part* AT&T Corp. v. Iowa Utils. Bd., 525 U.S. 366 (1999), *aff'd in part and vacated in part on remand*, Iowa Utils. Bd. v. FCC, 219 F.3d 744 (8th Cir. 2000), *cert. granted sub nom.* Verizon Comms. Corp. v. FCC, 531 U.S. 1124 (2001); Implementation of the Local Competition Provisions in the Telecomms. Act of 1996, *Order on Reconsideration*, 11 F.C.C.R. 13042, 4 Comm. Reg. (P & F) 1057 (1996); Implementation of the Local Competition Provisions in the Telecomms. Act of 1996, *Second Order on Reconsideration*, 11 F.C.C.R. 19738, 5 Comm. Reg. (P & F) 420 (1996); Implementation of the Local Competition Provisions in the Telecomms. Act of 1996, *Third Order on Reconsideration and Further Notice of Proposed Rule Making*, 12 F.C.C.R. 12460, 8 Comm. Reg. (P & F) 1206 (1997).

52. *See, e.g.*, Brief for Petitioner, Verizon Comms., Inc. v. FCC, 2001 WL 883672 (U.S. Sup. Ct. 2001) (No. 00-511); Reply Brief for Petitioners, Verizon Comms., Inc. v.

Some industry pundits, particularly those sympathetic to ILEC positions, believe that TELRIC pricing will be phased out and that eventually element prices will be based more on historical or opportunity costs than on forward-looking costs. There is little evidence from either the FCC or state regulatory commissions that TELRIC will be abandoned, or that historical costs, properly measured, exceed TELRIC. Nevertheless, the risk of dramatic changes in element rates (perhaps due to changes in pricing standard) cannot be trivialized.[53] Today, element rates are determined by regulatory fiat, and regulators can be fickle. Element-rate sabotage is a constant, though perhaps weak, threat.

Moreover, as Table 1 illustrates, those CLECs with a heavy dependence on ILEC facilities are required to sink other significant entry costs as well. For example, the sunk costs of systems and customer acquisition are not small. Nevertheless, the sunk costs of an element-dependent entry strategy are much less than those of a network-based entry strategy. Network facilities can be a severe drain on an entrant's resources and they substantially raise the risk of entry. Further, the speed with which customers can be acquired may not allow the entrant to exhaust the inherent scale economies in telecommunications plant.

Despite these risks of investing in telecommunications plants, some EDEs have duplicated major components of the ILECs' network to provide services. For example, switch-based CLECs typically acquire loop facilities from the ILEC, but cross-connect those loops to their switch and collocated equipment. DSL providers, similarly, cross-connect loop plant over to their collocation. While this hybrid element-facilities approach reduces reliance on the ILEC, substantial sunk costs are nonetheless required. Further, given the highly manual loop cutover process, the degrees of freedom for sabotage are expanded.

FCC, 2001 WL 893893 (U.S. Sup. Ct. 2001) (No. 00-511); Respondent's Brief, *FCC v. Iowa Utils. Bd.*, 2001 WL 705629 (U.S. Sup. Ct. 2001) (No. 00-511, 00-555, 00-587, 00-590, 00-602); Respondent's Brief, *WorldCom, Inc. v. Verizon Comms., Inc.*, 2001 WL 881072 (U.S. Sup. Ct. 2001) (No. 00-555, 00-587, 00-590); Petitioner's Brief, *Verizon Comms., Inc. v. FCC*, 2001 WL 705546 (U.S. Sup. Ct. 2001) (No. 00-511). Comments of Verizon Comms., Inc. Before the Nat'l Telecomms. and Info. Admin., *Request for Comments on Deployment of Broadband Networks and Advanced Telecommunications*, Docket No. 011109273-1273-01, (Dec. 19, 2000), *available at* http://www.ntia.doc.gov/ntiahome/broadband/comments/verizon/verizon.htm.

53. *First Report and Order*, *supra* note 50, paras. 555-607 (noting that the FCC's decision to adopt the TELRIC pricing methodology is on *certiorari* with the Supreme Court and oral arguments were held on October 10, 2001). *Cf. Iowa Utils. Bd.*, 120 F.3d 753 (upholding the FCC's generic authority to develop a pricing methodology under the 1996 Act).

The "smart-build" approach, where facilities are deployed in a highly controlled and meticulous fashion, has met with limited success, as have virtually all CLEC entry strategies. Nevertheless, the heavy burden of facilities deployment and the slow, arduous customer acquisition process have sent many CLECs to the grave.[54] Further, while the light use of ILEC facilities reduces reliance on the reluctant supplier, the ability of the ILECs to disrupt CLECs' business plans is not removed. Indeed, in some cases, those CLECs deploying their own plant to complement the ILECs' elements require even more ILEC intervention to provide service (e.g., the manual hot-cut process) than the more pure EDEs.

These hybrid entrants—those using both ILEC elements and their own facilities—represent the bulk of CLEC bankruptcies over the past year or so. This group consists primarily of those providers adopting the "build it and they will come" business plan. Not all of the hybrids will fail, however. On the other hand, other CLECs, with hundreds of millions in debt and slow revenue growth, probably never had a chance.[55] DSL provider Northpoint, for example, carried about $500 million in debt; $24 million in quarterly revenues, growing at 10% quarterly; and just over $100 million in quarterly costs, growing at 20% quarterly. This includes cost of goods sold and sales, general and administrative costs. As such, Northpoint and similarly situated CLECs were doomed from the outset.

While hope remains for a few of the hybrid entrants, the impact of the hybrid entrant on competition unfortunately will be *de minimis*. For example, switch-based CLECs face a severe constraint on migrating customers to their network: the highly manual hot-cut process. Every customer a switch-based CLEC acquires must be hot-cut over to the CLEC's collocation equipment.

Consider the effect of hot-cuts on competition in New York. In New York, about 7,000 hot-cuts are performed each month.[56] Assuming a 4% monthly churn rate, the number of access lines that CLECs can service at

54. A recent NEW YORK TIMES article illustrates this fact, noting that during 2001 the number of CLECs has declined from more than 200 to about 75. *See* Ilve Tahmincioglu, *A Phone Upstart, Still Annoying the Giants*, N.Y. TIMES, Nov. 4, 2001, § 3, at 6.

55. *See, e.g.*, Gregory Zuckerman & Deborah Solomon, *Telecom Debt Debacle Could Lead to Losses of Historic Proportions*, WALL ST. J., May 11, 2001, at A1.

56. This estimate is based on data from December 2000, when Verizon performed 6,878 hot-cuts. Letter to Honorable Janet H. Deixler, Secretary, New York Public Service Commission, Three Empire State Plaza, Albany, New York 12223 from William D. Smith, Senior Regulatory Counsel, Verizon, New York, Inc. 1095 Ave. of the Americas, Room 3733, New York, NY 10036, Re: Cases 97-C-0271and 99-C-0949 (Jan. 25, 2001) (on file with Journal). While the 6,000 hot-cuts is an averaged level of demand, hot-cuts do have a physical capacity constraint that is far less than that for UNE-P, because UNE-P migration, in most cases, does not require manual intervention.

existing hot-cut rates in New York in three years is about 135,000 lines, including the effect of churn. According to FCC ARMIS data, there are about 12 million access lines in New York, and this figure has been growing at about 0.25% per month during the past five years.[57] After three years of hot-cuts, roughly 1% of the total New York market could be served by switch-based CLECs.[58] Even with no churn, the percent of customers that switch-based CLECs could service is only 1.85%.[59]

As a point of reference, in December 2000, about 300,000 UNE-P and *UNE-P equivalent lines were provisioned to CLECs.*[60] *In other words,* UNE-P can produce a level of competition in a single month that switch-based CLECs cannot exceed even after three years (even with zero churn). In fact, UNE-P can provide service to nearly ten times as many customers in six months than could switch-based CLECs after ten years of hot-cuts, assuming current hot-cut levels.[61] As discussed *supra*, the rapid migration of customers to EDEs is important for the future of network-based competition.

B. Network-Based Entrants: The "Builders"

While we divide entrants into EDEs and network-based entrants ("NBEs"), it is generally the case that all CLECs use the incumbent's network to some degree. NBE means carriers that rely more heavily on their own facilities, using the dominant incumbent's network only in special circumstances. CLECs in this group at the time of this writing include Time Warner Telecom, XO Communications, RCN, and bankrupt firms such as Teligent and Winstar.[62] NBEs generally target medium-large

57. ARMIS Form 43-08 (multiple years), *at* http://www.fcc.gov/ccb/armis.

58. *Id.* The estimated CLEC share is computed as the net sum of the hot-cut access lines growing at 7,000 hot-cuts per month, but declining at 4% per month on the cumulative stock of CLEC lines, divided by the forecast access lines of Verizon (growing at 0.25% per month).

59. *Id.* The hot-cut customer base is assumed to grow at 7,000 lines per month, with no customer churn on the existing stock.

60. Letter to Honorable Janet H. Deixler, *supra* note 56. UNE-P migration levels are based on Verizon and CLEC customer activations during Dec. 2000. Both Verizon and CLEC activations are included because they are functionally equivalent and, therefore, are a better measure of account-activation capacity.

61. The estimated CLEC share on UNE-P is computed as the net sum of migrated UNE-P access lines growing at 300,000 migrations per month, but declining at 4% per month on the cumulative stock of CLEC UNE-P lines, divided by the forecast access lines of Verizon (growing at .025% per month). See footnote 59 for computations of hot-cut lines.

62. *Cf.* Richard Waters, *Crunch Time for the US Telecoms Industry*, FIN. TIMES, Apr. 30, 2001, at 26. Neither Time Warner nor XO Communications serves the mass market of analog telephone service.

and large businesses, and possibly residential multiple-dwelling units in metropolitan markets.

The sunk costs and economies of scale endemic in the local exchange market are discussed *supra*. Sunk costs raise the risk of entry, and the economies of scale associated with fixed/sunk costs require large market shares to attain profitability. The CLEC industry today is well aware of the difficulty of achieving scale economies and doing so relatively quickly.

The capital required of the NBE is substantial. As shown in Table 1, entry costs for XO Communications exceed $11 billion. Despite these large entry costs, about a third of which is in plant, the addressable market of XO Communications is relatively small. RCN Communications, with a network construction that is limited to the most densely populated areas, has entry costs of nearly $6 billion for a total addressable market of about 1.5 million households (totaling 1.3% of U.S. households). Access to this kind of capital by a large number of CLECs is unlikely.

Moreover, just as with the EDEs, the regulatory risks for NBEs are far from trivial. Permits and other government approval costs, again, mostly sunk in nature, average about 10% of total project costs.[63] Given that these costs are incurred prior to even receiving permission to construct, up-front investments in lengthy regulatory efforts substantially increase risk. In some cases, permission is not granted or is too costly, and these projects are consequently aborted.

While it seems that network-based entry would eliminate the prospects for ILEC strategic, anticompetitive behavior, even network-based entrants run into trouble with the incumbents. As one NBE observed, "When you go to the incumbents, the inventory of conduit always seems to be shrinking. They want you to go out and dig up the street and run up your own costs."[64] Thus, even those entrants that are network-based in nearly every respect must interact with the ILEC.

Moreover, the omnipresent regulatory risk in telecommunications even impacts the NBEs: "We're in a legal struggle right now where [the incumbent is] trying to say that we don't meet the definition of a CLEC because we're a 'carriers' carrier.' They don't want to unbundle anything."[65] Accordingly, it appears that even dividing up entrants as element-dependent or network-based is problematic. Every entrant must deal with the incumbent and is a potential victim of sabotage; it is just a matter of degree.

63. Sweeney, *supra* note 16, at 10.

64. *Id.* at 9.

65. *Id.*

IV. THE MODEL

The review of current entry strategies reveals two common themes. First, *the dominant, vertically integrated incumbent firm has powerful incentives to hinder, if not completely put out of action, those CLECs relying on its unbundled elements to provide service.* When an ILEC sells an unbundled loop to a CLEC in the wholesale market, that loop will almost certainly be used to serve a current customer of the ILEC in the retail market. If service provision is mutually exclusive, then the ILEC will lose that customer and the monthly margin associated with that customer. If the regulated price for elements does not compensate the ILEC fully for its cost and lost margin, then the ILEC is motivated to sabotage the transaction. Second, *entry into the local exchange market by a large number of providers likely will require access to unbundled elements supplied by either the ILEC or a CLEC.*

These basic ideas, mixed with the influence of scale economies and regulation, serve as the foundation for the economic model of incentives presented in this Section. While the presentation of the model is greatly simplified for consumption by a broad audience, the model is technical by its very nature. Numerical examples are provided at the end of the Section for those wanting to avoid the more technical presentation.

A. *Primary Assumptions of the Model*

All analyses are based on a particular set of assumptions, and this analysis is no exception. The assumptions chosen here simplify the analysis while capturing the salient features of the telecommunications markets under investigation. The assumptions used in the model here include the following:

(a) There is a large, integrated (wholesale and retail) incumbent (the ILEC) that is legally obligated to sell unbundled network elements to retail competitors at regulated prices;

(b) These incumbents may "sabotage" this process through nonprice means;

(c) Scale (or density) economies exist in network or wholesale operations, and these economies may be substantial;

(d) While scale economies may exist in retail operations, these economies are smaller than those in wholesale operations; and

(e) Wholesale services and elements are required to provide retail services, on a "one-for-one" basis.

The following notation simplifies the model:

MS_j retail market share (% of total market sales) enjoyed by firm j
$j = 1$ dominant firm
$j = i$ other integrated firms
$j =$ a, b, c, . . . stand-alone, nondominant retail firms;

S_k wholesale market share (% of total market sales) enjoyed by firm k
$k = 1$ dominant firm
$k = i$ other integrated firms
$k = w$ stand-alone, nondominant retail firms;

γ typical retail margin (revenues less retail costs and other service costs on a per-customer basis);

$C(S)$ total economic costs of a network of "size" S, representing all costs of the physical network and its operations with $C' > 0$, $C'' \leq 0$, and $C(0) = 0$;[66]

r regulated price of a piece of the network ("elements") used to provide service to retail customers;

z per-unit costs imposed on a competitor by a dominant provider of elements that do not result in a revenue to the provider, i.e. nefarious "sabotage";

r_i unregulated price of a network element sold by an integrated, nondominant firm, to a retail competitor of the seller;

r_w unregulated price of a network element sold by a firm having no other business to a firm offering retail services.

66. The notation $C'(S)$ indicates marginal cost, where marginal cost is the first derivative of the cost function with respect to the quantity of element produced. The second derivative of the cost function is $C''(S)$. These assumptions merely imply that producing elements is costly ($C'(S) > 0$), but that there are scale economies in this process ($C''(S) \leq 0$) and no fixed costs ($C(0) = 0$). Economies of scale could be defined as declining average cost (i.e., fixed costs are positive) with no change in the conclusions of the paper.

The following additional "empirical generalizations" are used in what follows: (a) the incumbent, integrated firm does not wish to sell elements to competitors at price t; and (b) margins and prices are such that retail competition is viable if retail competitors are able to obtain elements at the long-run average costs of an efficient competitor. The first generalization implies that the regulated rate for the element is below the opportunity cost of the element for the dominant incumbent, whereas the second generalization ensures that competition is viable and thus a reasonable expectation and policy goal.

B. The Cost of Selling Elements

The next step in the analysis is to characterize the opportunity costs of selling elements by integrated and unintegrated firms. Consider an integrated firm with network market share S and retail market share MS. The marginal opportunity cost of transferring control of one element to a competitor, t, is then:

$$t = C'(S) + MS \cdot \gamma \qquad (2)$$

where the first term, $C'(S)$, represents the ordinary marginal cost of an element given a network of size S.[67] The second term, $MS \cdot \gamma$, illustrates the potential impact of the sale on the retail portion of the seller's operations. Given a retail market share of MS, the (naïve) probability that the sale of the element results in a lost retail account is MS. *In other words, if the seller has 50% of the market, then there is a 50% chance that the purchaser of the element is then using that element to serve an existing customer of the seller.* Since a typical account produces a margin of γ, the expected lost retail margin on the sale is $MS \cdot \gamma$, and the total cost of the element transfer is therefore $C'(S) + MS \cdot \gamma$, the marginal cost plus the lost retail margin of the element.[68]

67. The Efficient Component Pricing Rule ("ECPR") calls for a price equal to t. TELRIC pricing is roughly equivalent to average cost pricing, or $C(S)/S$.

68. The Authors assume, for simplicity, that the retail margin γ is not affected by the sale of one element.

Two important points arise here. First, a seller with a larger network (i.e., S is larger) enjoys a lower marginal cost; if $S_a > S_b$, then $C'(S_a) < C'(S_b)$. In other words, there are economies of scale. Second, a seller with a larger retail operation faces a higher opportunity cost, t, since the sale of an element to a competitor is more likely to result in a lost retail account. The relationships between the opportunity cost, $C'(S) + MS \cdot \gamma$, and the shares S and MS are illustrated in Figure 1.

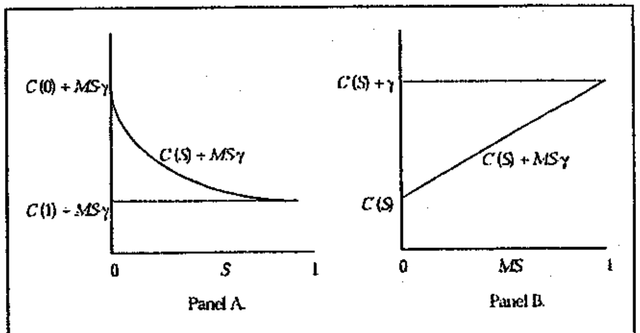


Figure 1. Opportunity Cost and Market Share

The relationship between wholesale market share and opportunity costs is illustrated in Panel A. For a given market share and retail margin, opportunity costs are declining in wholesale market share. This relationship also implies that marginal cost, $C'(S)$, is declining in wholesale market share (there are economies of scale). Panel B illustrates the relationship between retail market share and opportunity costs. With marginal production cost constant, the larger the market share of the firm, the larger the opportunity cost. This relationship is based on the expected relationship between the forgone retail margin and the sale of an element, since marginal production costs are constant.

Because a wholesale-only firm has no retail market share, the opportunity cost of providing an element for a wholesale-only firm is just $C'(S)$. Given the existence of scale economies, a price of $C'(S)$ is not consistent with long-term financial success. Scale economies imply that marginal cost lies below average cost, so that a price equal to marginal cost does not fully recover the total cost of the firm. Long-run average cost, $C(S)/S$, is the minimum price consistent with viability of a wholesale-only seller.[69]

C. *The Price of Elements*

The next step in the model is to analyze the conditions under which element sales can be made. Figure 2 illustrates the opportunity cost to the dominant firm from selling one or a few elements, and the regulated level of remuneration they obtain from such sales ($\bar{r}$).

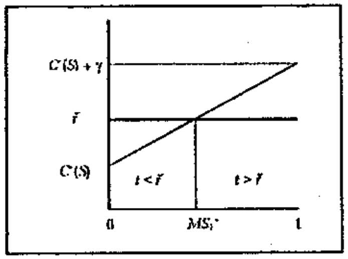


Figure 2. Revenue, Opportunity Cost and Market Share

The model assumes on Figure 2 that $\bar{r}$ is sufficiently high: $\bar{r} \geq C(S_1)$, where $\bar{r}$ exceeds the long-run incremental cost of the dominant firm. This is not the same as assuming $\bar{r}$ is remunerative, however, since scale economies are present. The analyses to follow do not depend on this relationship.

Figure 2 illustrates an important fact: the dominant incumbent is willing to sell an element at price of $\bar{r}$ only if $MS_1 < MS_1^*$ where $t < \bar{r}$. At all higher market shares, the opportunity cost t exceeds $\bar{r}$ and the incumbent is unwilling to sell elements. This unwillingness to sell elements is driven by the lost retail margin of the dominant incumbent $MS \cdot \gamma$. The conclusion is strengthened if γ falls as element sales are made because the seller is marginalizing; the elements reduce the margin on all units sold in the retail operation of the seller.[70] Thus, if element sales increase price competition in

69. Note that $C(S)/S$ is the functional equivalent of TELRIC.

70. Lower retail margins reduce opportunity costs and thus encourage element sales. However, the seller will not purposefully reduce its retail margin through the sale of elements to reduce its opportunity costs; the reduced margin affects all customers.

the retail market, then the incumbent's incentive to sell elements in the wholesale market is diminished. For simplicity, this model considers the sale of a single element with presumably negligible effects on retail margins. Nevertheless, the impact of price competition on the incumbent's incentives is noteworthy.

D. *Sabotage*

"Sabotage," as used in this Article, has a very specific definition, that is, the ability of a dominant firm to raise the cost of a rival's key input of production by nonprice behavior. While sabotage can occur in a variety of contexts, the inherent tension created by the wholesale supplier versus retail competitor conflict, especially when the wholesale price is regulated, provides fertile ground for abuse. That is to say, the dominant, integrated firm is regulated and is legally required to sell elements at price $\bar{r}$. Here, however, experience highlights the substantial gulf between the requirements of the 1996 Act and reality. Suppose that the regulated, dominant firm can impose nonprice costs of z, where $z \geq 0$, per element on buyers, although they will earn no revenue by this action; that is, z is a cost to buyers but not a revenue to the seller.[71] Given this possibility, at what level, if any, would the dominant firm choose to sell?

It is clear that, when $MS_1 < MS_1^*$ the dominant incumbent does not want to sell elements. Thus, in this situation, z will be set at its maximum feasible value to impede the sale of elements. Because the sale of a single element is undesirable, the sale of more than one element is also undesirable because a larger quantity of elements sold is more likely to reduce or merely not increase the retail margin.[72] Cost-based prices do not, and should not, incorporate such margins. Thus, cost-based prices are set below the opportunity cost of the incumbent. *Consequently, to the extent that the incumbent dominant firm is able to impose costs on rivals, its incentives are to do so.*[73]

71. Beard et al., *supra* note 11, at 105.

72. The model shows that the dominant incumbent will not sell one element. This specification of the model is for convenience, but the same result holds for larger quantities of elements sold.

73. A similar situation can be observed in the market for multichannel-delivered video programming. There, both the upstream (programming) and downstream (distribution) markets are also characterized by high sunk costs and the necessity of achieving scale economies. For this reason, many cable multiple system operators ("MSOs") sought to mitigate their risks by vertically integrating with popular cable networks. As access to these popular cable networks was key to the ability of a competitor—such as satellite providers or cable overbuilders—to succeed in the market, these vertically integrated cable MSOs had a strong incentive to engage in strategic anticompetitive conduct against their rivals and ultimately did. In order to stop such anticompetitive conduct, Congress was forced to

E. *Sales by a Vertically Integrated Nondominant CLEC Provider*

What of element sales by a nondominant vertically integrated CLEC provider? The above analysis can be extended beyond the dominant incumbent to any integrated seller, including CLECs. An integrated seller is willing to sell an element at any price r only if its market share is less than a critical value determined by $C'(S_i)$, γ, and MS_i. For example, an integrated but nondominant seller would sell an element at price r only if $r > C'(S) + Ms_i \cdot \gamma$. Of course, such a price may not be remunerative with substantial scale economies at S_i, but this relationship serves as a lower boundary. Note that the value of $C'(S_i)$ may be quite high when S_i is small, as are many CLECs, due to scale economies in network elements.

Competition, to the extent that it exists among sellers of elements, may impose a maximum price that any given integrated seller can charge for an element. If so, call that price r_{max}. Given S_i, γ, and MS_i, we may well have $MS_i > MS_i^*$ for r_{max}, implying no sales of elements by larger integrated, unregulated firms because the large retail market share increases the opportunity costs of such sales. This "no sales of elements" strategy is more likely when retail operations of the firm (MS_i) are larger, the retail margin (γ) is larger, and the wholesale operations of the firm (S_i) are smaller. Importantly, the nondominant supplier's wholesale rates are unregulated, so there is no incentive for strategic nonprice anticompetitive behavior. The nondominant wholesale firm responds to its incentives by adjusting price.

Clearly then, the presence of scale economies also affects the behavior of vertically integrated CLECs as well, but in what way? The model indicates that while a vertically integrated CLEC may not opt for a separate wholesale business strategy in addition to its retail operations, the CLEC will not go out of its way to frustrate entry as the ILEC would. That is, *sabotage is the result of regulated prices for elements that are below the opportunity cost, but not necessarily the average cost, of the incumbent*. Yet, because the price for elements is not prescribed for unregulated sellers (CLECs), these firms have no incentive to sabotage transactions. However, as also noted above, the higher the opportunity cost of the unregulated firm, the higher is r_i—the price at which the unregulated firm will sell elements.

promulgate the Program Access rules in the 1992 Cable Act to require vertically integrated MSOs who deliver programming over satellite to demonstrate why their exclusive distribution programming contracts were in the public interest. 47 U.S.C. § 548 (Supp. V 1999). For a full exegesis of the Program Access paradigm, *see* James W. Olson & Lawrence J. Spiwak, *Can Short-Term Limits on Strategic Vertical Restraints Improve Long-Term Cable Industry Market Performance?*, 13 CARDOZO ARTS & ENT. L.J. 283 (1995); *see also* George S. Ford & John D. Jackson, *Horizontal Concentration and Vertical Integration in the Cable Television Industry*, 12 REV. OF INDUS. ORG. 501, 504-06 (1997).

The element price r_i is decreasing in S_i and increasing in MS_i and γ. *Accordingly, a fully integrated nondominant CLEC provider with a significant market share in the retail market will not affirmatively seek to thwart entry. Instead, this CLEC will simply offer elements to the wholesale market at "high" prices. As a result, while an EDE may be able to purchase some elements from a CLEC for short-term purposes, purchasing elements from the ILEC is always fraught with peril.*

F. *Summary of Model with a Numerical Example*

Although of a fairly technical nature, the model described here merely formalizes a fairly simple and common-sense notion: whenever an integrated firm sells a network element, or network services, to a retail competitor, there is a chance that sale will cause the integrated firm to lose a customer to the buyer. In a sense, such sales to retail competitors involve the risk of also "selling" a valued customer, and the integrated firm will recognize this fact in its actions toward those seeking wholesale services. Further, the risk of such a loss to the seller is related directly to the seller's market share in the relevant market. For example, a firm with a near-monopoly in the retail market will almost surely lose a customer if it supplies a retail competitor with the ability to offer further retail services. There is, after all, almost nowhere else from which such a customer could come.

The reluctance of integrated sellers to sell elements or wholesale services can be measured by the prices they would induce to voluntarily sell such elements to competitors. Further, in order for elements to be sold by an integrated firm, the price charged must also be below the potential earnings of the buyer, so that the sale is economically sound for the retail firm. The analysis presented here allows this requirement to be analyzed and understood using simple numerical examples.

To make it concrete, suppose that in some given market the economic cost of the necessary element—$C'(S)$ in the model—is $15 per month for a firm with a 50% market share in the wholesale market. Suppose further that, given the additional costs arising from retailing, an efficient retail service supplier could expect to earn a margin of $25 per month—$\gamma$ in the model—not counting the costs of the wholesale element. This implies that, given an element of cost $15, a customer in hand is worth $10 ($25-$15). Then, the prices in the second column of Table 2, r_{min} in the model, would be required by the integrated seller in order to induce them to sell the element, with these figures related to the integrated firm's market share in the relevant market.

Table 2. Minimum Element Prices

Retail Market Share (MS)	Minimum Element Price (r_{min})
0%	15.00
25%	17.50
50%	20.00
75%	22.50
100%	25.00

Although a very simple example, these calculations show that the willingness of an integrated seller to provide a wholesale service to a retail competitor is directly and positively related to the retail market share of the integrated firm. Since a potential competitive retailer that might seek to buy elements is likely to be operating on lower margins than the existing dominant firm, element prices of the sort illustrated here can be expected to substantially reduce the sales of elements and the emergence of competition at the retail stage.

G. *Market Examples*

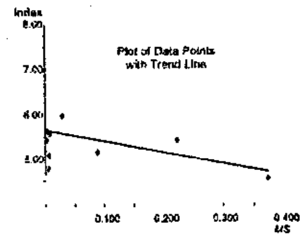
Because there are no integrated, nondominant CLEC suppliers of local exchange elements, comparable examples must be found elsewhere. As an analogy, consider the wholesale market for long-distance services, where the "element" in this context is access to a nationwide long-distance network. In the long-distance market, the retail market share variable MS is properly characterized as the underlying carrier's national market share; the long-distance market is national in scope. Any customer of an integrated interexchange carrier is potential prey for a retail carrier using the facilities of the integrated firm. Assuming γ is equal across firms and scale economies are exhausted for all national long-distance networks, the expectation is that the price charged by interexchange carriers with large retail market shares would be higher than those without such shares.

Table 3 provides an analysis of customer perceptions of a representative sampling of wholesale carrier price points and the respective carriers' retail market share. The model suggests that AT&T, the largest retail provider of long-distance service, would have the highest prices for wholesale capacity. Table 3 indicates that customers and potential customers of AT&T wholesale capacity view its prices as relatively high, resulting in the lowest rating for pricing (4.26). Further, those carriers with the smallest retail market shares are given the highest rating for pricing (7.00). While the data presented in Table 3 are not perfectly comparable to

the analysis above (the market share data are not perfectly analogous and other factors influence price), the general relationship is compatible with expectations. Furthermore, while AT&T has the largest network and largest retail market share, MCI-WorldCom is the largest wholesale carrier. It appears that AT&T's retail market share continues to influence the company's behavior in the long-distance wholesale market.

Table 3. Pricing Satisfaction and Market Share of Interexchange Carriers[74]

Carrier	Pricing Satisfaction Index*	Market Share
AT&T	4.56	0.376
Cable & Wireless	5.08	0.008
Global Crossing	5.57	0.008
Broadwing	4.79	0.006
MCI WorldCom	5.42	0.225
Qwest	5.98	0.030
Sprint	5.15	0.090
Teleglobe	5.42	0.003
Williams	5.63	0.004
Misc. Small Carriers	7.00	N/A
Mean	5.49	



* Higher values indicate lower prices.

In stark contrast to the highly competitive market for wholesale capacity in long-distance services, the wholesale market for the U.S. wireless industry is immature. The opportunity cost model sheds some light on this fact. Historically, the margins (γ) for wireless service have been quite high. Further, the wireless carriers have only recently begun to exhaust scale economies, suggesting $C'(S)$ was large historically. Today, market shares have somewhat stabilized, allowing wireless carriers to better assess their opportunity costs. With wireless margins lower, market shares stable and disparate, and scale economies near exhaustion for some carriers, the model presented above suggests that a wholesale market in

74. Judy Reed Smith & Taher Bouzayen, *Resellers Rate Wholesale Carriers*, PHONE+, March, 2000; Trends in Telephone Service, Federal Communications Commission, August 2001 (Data for year 2000), at Table 10.1.

wireless telecommunications may emerge.

Notwithstanding the situation in the United States, the formation of such a wholesale wireless market is nonetheless well under way in the rest of the world. These self-described mobile virtual network operators ("MVNOs") such as Virgin Mobile, Sense Communications, and the Financial Times Group (firms that are essentially "marketing machines")[75] are all making significant headway in numerous markets in Europe, Asia, and Australia.[76] Not surprisingly, recent trade press reports reveal that several U.S. wireless carriers are warming up to the idea of offering their capacity as wholesale suppliers as well.[77]

75. *See, e.g.*, Reuters, *Branson to Use Virgin Airline as Mobile Weapon*, TOTAL TELECOM, Sept. 3, 2001, *available at* http://www.totaltele.com/view.asp?articleID=43387&Pub=TT&categoryid=828&kw=Branson+touse+Virgin.

76. *See, e.g.*, *Telecom NZ's AAPT Looks for Australia MVNO Deals*, TOTAL TELECOM, Sept. 17, 2001, *available at* http://www.totaltele.com/view.asp?articleID=43860&Pub=TT&categoryid=828&kw=Telecom+NZ; *Virgin Plans US$550m Asian Spend, Sees HK Partner Soon*, TOTAL TELECOM, June 12, 2001, *available at* http://www.totaltele.com/view.asp?articleID 40900&Pub TT&categoryid 828&kw Virgin+ (noting, according to Ross Cormack, Chief Executive of Virgin Mobile (Asia), that the U.K.-based Virgin Group "plans to spend US$550 million on expanding its mobile virtual network operations in 10 Asian regions over the next three to five years"); Ray Le Maistre, *Operators: MVNOs - Not All Virgins*, ROAM, June 1, 2001, *available at* http://www.totaltele.com/roam/ view.asp?articleID=40602&Pub=RM&categoryid=705&kw=Virgins; George Malim, *COR Boosts the Power of Smaller MVNOs*, TOTAL TELECOM, May 21, 2001, *available at* http://www.totaltele.com/view.asp?articleID=40104&Pub=CWI&categoryid=705&kw=COR;Annie Turner, *Mobile Virtual Network Operators: Taking Root*, NEW CARRIER, Apr. 1, 2001, *available at* http://www.totaltele.com/newcarrier/view.asp?articleID=39455&Pub=NC&categoryid=705&kw=Root; Anne Young, *FT and the Carphone Warehouse Form MVNO Deal with Cellnet*, TOTAL TELECOM, Mar. 5, 2001, *available at* http:// www.totaltele.com/view.asp?articleID=37582&Pub=TT&categoryid=625&kw=Carphone; Joanne Taaffe, *Mobile Virtual Network Operators - Marking Out Their Territory*, COMMUN. WEEK INT'L, Mar. 5, 2001, *available at* http://www.totaltele.com/view.asp?articleID=37530&Pub=CWI&categoryid 705&kw Mobile+Virtual+Network; Anne Young, *MVNOs: A Market Essential or an Operator's Bete Noire?*, TOTAL TELECOM, Feb. 22, 2001, *available at* http://www.totaltele.com/view.asp?articleID=37255&Pub=TT&categoryid=625&kw=Bete+Noire; Gerard O'Dwyer, *Norwegian MVNO Sees Sense in Nordic Expansion*, TOTAL TELECOM, Feb. 6, 2001, *available at* http://www.totaltele.com/view.asp?articleID=36637&Pub=TT&categoryid=625&kw=Norwegian+MVNO; Emma McClune, *3G Owners Awash with Virtual Partner Offers*, COMMUN. WEEK INT'L, Jan. 15, 2001, *available at* http://www.totaltele.com/view.asp?articleID=35683&Pub=CWI&categoryid=705&kw=3G+owners.

77. *See, e.g.*, Bruce Christian, *Wanted: Channels for Wireless*, PHONE+, Mar. 2001, *at* http://www.phoneplusmag.com/articles/131cover.html; *Virgin Teams Up With Sprint for U.S. Services*, REUTERS, Oct. 5, 2001; *Sprint, Virgin Form Wireless Joint Venture Aimed at 15- to 30-Year Olds*, BUS. J., Oct. 5, 2001, *at* http://www.kansascity.bizjournals.com/kansascity/stories/2001/10/01/daily46.html; Thor Olavsrud, *Sprint, Virgin Create Wireless Joint Venture*, WIRELESS NEWS, Oct. 5, 2001, *at* http://www.internetnews.com/wireless/article/0,,10692_898121,00.html.

V. IMPLICATIONS OF THE MODEL AND THE CASE FOR AN ADCO

A. Emerging Trends

The analysis above indicates that the opportunity cost of selling elements rises as wholesale market share declines and retail market share increases (holding the retail margin constant), suggesting the following possible conclusions. First, there is reason to believe that *no integrated firm with large retail presence will emerge as an efficient, cost-based supplier of network elements to retail competitors. Moreover, the regulated, dominant firm, and any larger integrated firm, may well be reluctant to create its own competition through element sales.* For both dominant and nondominant providers, there is a clash between scale economies on the one hand and retail market share on the other. Size does matter, so to speak, but in conflicting ways. For an integrated provider offering no elements to the wholesale market, wholesale (S) and retail market share (MS) are highly correlated. The opportunity cost of selling elements declines as wholesale market share increases; the opportunity cost of selling elements increases as retail market share increases. *Thus, it is quite possible that the lowest cost providers—those exhausting economies of scale—do not participate in the wholesale market, particularly at better prices, because of a high retail market share.*

Second, the presence of scale economies suggests that small wholesale firms, or retailer self-supply, may likewise be noneconomic. *Realizing economies of scale affects profitability; thus, exhausting scale economies is desirable. However, doing so may be difficult if wholesale market share is tied directly to retail market share.* An integrated firm may be unable to acquire sufficient retail share to exhaust scale economies at the wholesale level. The retail market share of the firm, however, may impede the firm's ability to increase wholesale sales to achieve scale economies by raising the opportunity cost of element sales. Thus, numerous forces operate against the prospect of wholesale supply by integrated firms, whether dominant or nondominant.

Similarly, *a large retail market share indicates that the incumbent will have a significant incentive to sabotage and discriminate against rivals in the wholesale market.* Further, *the scale economies in the local market are more significant than in long-haul networks and therefore it is unclear whether individual EDEs will ever acquire sufficient market share to justify the construction of network for their exclusive use.* As such, *for those firms that rely heavily, if not exclusively, on the incumbent to provide wholesale elements at just and reasonable rates, the economics do not bode well for long-term viability.*

What, then, is the alternative? The analysis presented here illustrates a potential market-based solution to this dilemma: the entry of the wholesale-only firm or ADCo. Such a firm can offer retail entrants the immediate advantages of larger scale, thus obtaining scale economies in network operation, without the retail-market-share-driven disincentives to wholesale supply. In addition, given the wholesale nature of the ADCo and advances in technology, retail entrants can use the ADCo's facilities (i.e., essentially a "dumb pipe") to provide customers with custom-tailored products and services that the incumbent network is simply unwilling or unable to provide (e.g., managed IP services). Accordingly, while the number of local access networks the market can sustain may be *few*, the wholesale nature of the ADCo nonetheless permits the number of providers of advanced telecommunications products and services in the local market to be *many*.

Specifically, an ADCo can and is willing to offer elements with an economic cost of $C(S_x)$, and at a fully remunerative price of $C(S_x)/S_x$ (i.e., average cost). So long as such a firm is able to achieve sufficient scale economies, it may well be that $C(S_x)/S_x < r_{min}$, where:

$$r_{min} = \min\{C(S_I) + MS_I \cdot \gamma, C(S_i) + MS_i \cdot \gamma\}$$

or, equivalently:

$$r_{min} = \min\{r + z, C(S_I) + MS_I \cdot \gamma\}.$$

In other words, the average cost of the ADCo may be below the opportunity cost (or minimum element price) of its potential integrated rivals.[78]

Table 2 above can be expanded to include the minimum price of the ADCo, assuming that the ADCo and the integrated provider have the same cost function, but that ADCo, by definition, has no retail market share. Thus, the minimum remunerative element price for ADCo is equal to its average cost ($C(S)/S$) or TELRIC—$18.00 in this case.[79] As shown in Table 4, ADCo's price is below the integrated firm's price in some cases. As the retail market share of the integrated firm rises, the ADCo price is below the integrated firm's price. The difference in prices is the result of the retail

78. If not, then retail firms will pay the integrated providers their opportunity cost.

79. The ADCo cannot sell elements at marginal cost, whereas the incumbent may do so because its network costs are sunk. In other words, an ADCo would not enter the market, and incur sunk costs, if its expected price did not exceed marginal cost.

market share disincentive ($MS \cdot \gamma$) possessed by the integrated firm.

Table 4. Minimum Element Prices

Integrated Firm's Retail Market Share (MS)	Integrated Firm's Minimum Element Price (r_{min})	ADCO Minimum Element Price (r_{min})
0%	15.00	18.00
25%	17.50	18.00
50%	20.00	18.00
75%	22.50	18.00
100%	25.00	18.00

The condition under which the ADCo can profitably service the wholesale market does not require that the ADCo exhaust its scale economies. Even if the ADCo is somewhat less efficient than larger providers, due to a smaller size, the lack of the retail-driven disincentive may allow the ADCo to profitably supply a wholesale market. Thus, the presence of more efficient, integrated firms is immaterial so long as the retail-driven disincentive to supply the wholesale market is sufficiently large.

B. *Residual Public Interest Benefits—The Impact of the ADCo on the Incentives of the Dominant Incumbent*

Perhaps the most important benefit of the ADCo would be its potential effect on the incentives of the dominant incumbent to exercise market power (i.e., by raising prices or restricting output) or to engage in efforts to deter new entry via strategic nonprice behavior.

For example, it may just be possible that an ADCo, and its customers serving the retail market could grow large enough that the market shares of the integrated firms, both wholesale and retail, fall sufficiently to render them valid competitors in the wholesale market.[80] Thus, like structural separation of the dominant provider that aims to eliminate the retail disincentive in a more direct way, the ADCo can alter the incentives of the dominant provider so that supplying the wholesale market at competitive prices is economic.

More importantly, it may be the case that the presence of an ADCo will have an even more profound effect on long-term industry structure. That is to say, ever since the AT&T divestiture, there has been great

80. This result is neither indicated nor required by the model.

discussion about the prospect of legally mandating incumbents to separate structurally their network operations into a separate LoopCo.[81] Structural divestiture, by separating retail and wholesale operations, eliminates the retail market share disincentive to supply the wholesale market, as well as the incentive to sabotage. Regardless of the economic merits of such a structural separation, however, such a notion appears to be a political nonstarter.[82] Given the incumbent's inherent incentive to block entry, as discussed *supra*, it is nonetheless reasonable to inquire whether there could be some mechanism or circumstance where an incumbent would find it more efficient to disaggregate voluntarily its local access.

The presence of an ADCo may just be the catalyst needed to provide an incumbent with the incentive to disaggregate its network facilities from its marketing operations voluntarily. If the ADCo reveals any diseconomies of vertical integration (to the extent they exist), then vertically integrated firms may choose to divest themselves *voluntarily*, because it would be more efficient (i.e., more *profitable*) for them to do so. This voluntary restructuring would be the consequence of an ADCo revealing the presence of diseconomies of scale, scope, or sequence between the retail and wholesale components of the firm.[83] A full analysis of this possibility is

81. *See* Morris, *supra* note 14.

82. For example, some argue that a LoopCo would be economically unsustainable. *See, e.g.*, Jeffrey A. Eisenach et al., *Regulatory Overkill: Pennsylvania's Proposal to Breakup Bell Atlantic*, Progress and Freedom Foundation, Dec. 16, 1999, *at* http://www.pff.org/papucreport.htm. The economics indicate the opposite conclusion, however. First, the LoopCo's costs are sunk, and it has already achieved the scale economies necessary to be successful. As such, it will be established in a market capable of sustaining only a few firms. Second, assuming *arguendo* that there are no other local access facilities (or even a few), it is highly likely that regulators will still impose some sort of price regulation on the LoopCo. As such, it is unclear how a LoopCo would be economically unviable when its operational costs are guaranteed by regulation. Finally, it may turn out that the LoopCo would exceed its regulatory rate of return through the market because divestiture has removed its incentive to discriminate and replaced it with an incentive to sell as much of its product (i.e., local access) to as many potential buyers as it could find. Indeed, if a LoopCo is really such an inefficient business proposition, then why did British Telecom reject offers of $11.4 billion and $25.7 billion respectively for its local access networks from firms who realized the benefit of breaking out the value of BT's assets via a LoopCo? *See* Dan Roberts, *BT Rebuffs •8bn Offer for Lines*, FIN. TIMES, July 30, 2001, § 1, at 19 (quoting potential purchaser as believing that "BT has ignored the potential of its local loop because any ADSL services provided by rival operators compete with its own retail division."); Andrew Ward, *WestLB in $25.7bn Offer for BT Fixed-line Network*, FIN. TIMES, Aug. 5, 2001.

83. *See* George J. Stigler, *The Economics of Information*, 69 J. OF POL. ECON., ISSUE 3 (JUNE 1961) at 213-25; DANIEL F. SPULBER, REGULATION AND MARKETS 119-20 (1989); WILLIAMSON, *supra* note 8.

A classic example of how changing the underlying structure of the market can force firms to "voluntarily" disaggregate can be found in AT&T's spin-off of Lucent Technologies (né Bell Labs). To wit, back when AT&T had a total monopoly over everything short of the spoken word, it was very efficient for AT&T to bring the terminal

beyond the scope of this model and Article, however.

VI. CONCLUSION

The purpose of this Article is to shed some light on the path of future evolution in the competitive telecommunications industry, as well as to explore its somewhat troubled past and present. While it is always desirable to break new ground in research, this analysis will not be particularly groundbreaking to those most familiar with the telecommunications industry. Indeed, this analysis, in many respects, is a formalization of ideas shared among industry insiders for decades.[84] The economics of the telecommunications industry, particularly the supply-side economics, has not changed much over time. Fewness in supply is the rule, not the exception. Instead, fiber optics and other technological innovations remain key drivers of industry structure, notwithstanding the inherent economies of scale and sunk costs of telecommunications networks. As Professors Carl Shapiro and Hal Varian succinctly state in their book *Information Rules*: "*Technology changes. Economic laws do not.*"[85] Accordingly, if

equipment sector of the industry "out of the market and into the firm"—i.e., manufacture its terminal equipment on a vertically integrated basis. In the mid-Eighties, however, as long-distance competition was in its infancy, a more forward-looking FCC [realized] that competitors should have more than one source of terminal switching equipment (i.e., AT&T/Bell Labs). As such, through stringent structural regulation such as standard interfaces and plugs, the FCC essentially carved-out the terminal equipment market to allow for competing suppliers.

By the mid-1990's, the market for terminal equipment was flourishing. Not only was there Bell Labs/AT&T, but also other vendors such as Cisco, Siemens and Nortel and a wide variety of other niche technology players as well. As the result of this competition for terminal equipment, the equipment vendor side of AT&T found it was losing customers because, as a corporate entity, it was prohibited from selling to would-be rivals, and the network/marketing side of AT&T was limited only to what Bell Labs came up with. Given this changed market structure, it was now more efficient (i.e., more profitable) for AT&T to disaggregate voluntarily Bell Labs (now Lucent) from AT&T's telephone business (i.e., bring the transaction out of the firm and into the market). In so doing, both firms are better off, as Lucent can now sell to a wide variety of customers, and AT&T now has a choice of competing terminal equipment vendors who distinguish themselves on both a price and/or service quality or technological basis. *See* NAFTEL & SPIWAK, *supra* note 4, at 35.

84. Indeed, the notion of an ADCo was first fleshed out by Jerry B. Duvall in 1998, and has been written about frequently since then. *See* Jerry B. Duvall, *Entry by Electric Utilities Into Regulated Telecommunications Markets: Implications for Public Policy*, Paper Presented Before the Communications Industry Committee, ABA Section of Antitrust Law, Collier, Shannon, Rill & Scott, PLLC, Washington, D.C. (Feb. 6, 1998) *at* http://www.ascent.org/research/phoenix-ctr12.pdf. For sources discussing Duvall's notion, see, for example, Lawrence J. Spiwak, *Utility Entry Into Telecommunications: Exactly How Serious Are We?* (Phoenix Ctr. Policy Paper No. 1, July 1998), *available at* http://www.phoenix-center.org/pcpp/PCPP1Final.pdf; NAFTEL & SPIWAK, *supra* note 4, at 208-09.

85. CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES 1-2 (1999) (emphasis added).

network-based competition of a highly fragmented nature is desired, then competition policy is fighting a losing battle.[86]

In the most general of terms, this Article discusses important economic characteristics of local exchange markets and the firms that participate therein. First, entry into the local exchange market requires large fixed and sunk costs, making entry risky and necessitating scale economies. Consequently, only few local access networks can supply the market. These few local access networks cannot be small, however, because a large market share is required to realize sufficient scale economies to compete effectively with the ILECs and survive.

Secondly, acquiring sufficient market share to realize scale economies may be difficult for entrants that are not wholesale-only firms. Given the substantial scale economies in local exchange networks, it may not be possible for a single carrier to acquire sufficient retail market share in a timely manner to exhaust economies of scale. An integrated firm supplying the wholesale market is conflicted; the integrated firm's retail market share raises the opportunity cost of wholesale supply.

Accordingly, if economies of scale are sufficiently large, then reaching a scale of operation that allows the entrant to compete with the ILEC may be best achieved through a wholesale-only entry strategy—an ADCo. The ADCo can consolidate the consumer demand held by retail CLECs, thereby reducing risk and costs, and expanding output quickly. The disincentives to wholesale supply possessed by the integrated firm, furthermore, do not exist for the ADCo, and therefore the ADCo—unlike the ILEC—has no incentive to sabotage its customers. As a result, the ADCo provides the answer to the central objective of the 1996 Act: that is, while the number of local access networks the market can sustain may be *few*, the wholesale nature of the ADCo nonetheless permits the number of providers of advanced telecommunications products and services to be *many*, which—after all—is the *raison d'être* of market "restructuring."

86. *See, e.g.*, Review of Reg. Requirements for Incumbent LEC Broadband Telecomm. Servs., *Notice of Proposed Rule Making*, CC Docket No. 01-337 (Dec. 20, 2001), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-01-360A1.pdf. *But c.f.* Lawrence J. Spiwak, *Outside View: The Broadband Shibboleth*, UNITED PRESS INT'L, Dec. 13, 2001, *available at* http://www.upi.com/view.cfm?StoryID=10122001-052454-2749r.

Facilities-based Entry in Local Telecommunications: An Empirical Investigation

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... an empirical question cannot be settled by non-empirical arguments.
George Stigler, *The Organization of Industry* (1968), p. 115.

I. *Introduction*

Over the past decade or so, considerable attention has been directed to the promotion of competition in and the eventual deregulation of the public utilities -- gas, electricity, and local telecommunications. As part of this effort, potential competitors often are given access to elements of the incumbent monopolist's network or plant.[1] Such access is required when particular elements of the incumbent network continue to possess natural monopoly characteristics such as sizeable scale and scope economies.[2] Whether access to these elements is based on the theory of "essential facilities" of antitrust or "unbundled elements" of the Telecommunications Act of 1996, the result is the same: entrants are allowed to use the facilities of the incumbent as their own, and such access is priced at some measure of "cost," typically some variant of forward-looking economic cost.

[1] In some cases, such as local telecommunications, the incumbent continues to provide retail services so that the entrants are both competitors and customers (or "competitor customers") of the incumbent. In others, such as electricity, the incumbent often is prohibited from participating in the market targeted for competition and deregulation (whether upstream or downstream).

[2] Such supply-side characteristics are prevalent in the more geographically local elements of the aforementioned utilities' plant.

A principle difficulty faced by policy makers in this context is which elements of the network are "essential facilities" or satisfy some other governing standard. Economists and lawyers have described numerous problems with both the over- and under-inclusion of elements within the (broad) category of "essential." One frequent concern, particularly in the debate over local exchange telecommunications competition, is that by giving entrants access to parts of the network, those components of the network will never be duplicated and thus subject to the competitive pressure required to deregulate. This substitution effect, commonly couched in terms of a "make-or-buy" decision by the entrant, often lies at the core of the arguments by those calling for a less inclusive policy on what is or is not "essential."

While the "make-or-buy" claim is no doubt superficially appealing, the purpose of this paper is to evaluate this substitution effect in both a theoretically and empirically rigorous way. Theoretically, the presence of a substitution effect is undeniable. However, the theory reveals two other effects, one working with (the *scale effect*) and the other against (the *entry effect*) the substitution effect. Which of the three effects dominates cannot be determined solely by theory. Consequently, an empirical test of the theory is conducted, with the deployment of switching equipment by competitive local exchange carriers ("CLECs") as a case study. This case study is particularly relevant to this issue, given that the entrant's access or lack thereof to the switching function of the local exchange network is the subject of heated debate. The empirical results indicate that for this particular case, the substitution effect is not dominant; restricted access to the "switching element" of the local exchange access, either through higher prices are outright restrictions, will not encourage facilities deployment by entrants.

The empirical findings of this paper provide important guidance for competition policy in the local exchange telecommunications market. Indeed, at the heart of the current telecommunications policy debate lies a key unanswered question: what public policy will best promote facilities-based entry into the local exchange telecommunications marketplace? At the center of the debate is the question as to whether the requirement of the 1996 Telecommunications Act that incumbent local telephone carriers ("ILECs") provide access to their local networks to new entrants ("CLECs," or competitive local exchange carriers), or the requirement that such access be made available at "cost," promotes or deters facilities-based entry.[3] The ILECs encourage policy makers to limit access to their

[3] The Telecommunications Act requires that network access, or unbundled elements ("UNEs") be price at "cost." Cost was to be defined by the Federal Communications Commission, and that agency adopted a total-element, long-run incremental cost ("TELRIC") cost standard.

network and, when access is provided, that it be priced high. Without access to the incumbent's network or with access only at high prices, the ILECs contend that CLECs will be forced to deploy their own facilities and consequently will do so. In other words, the ILECs implicitly assume there exist a strong substitution effect between access to the existing network and the construction of new network. The CLECs, the Federal Communications Commission ("FCC"), and Congress disagree. While the debate over unbundled elements does not lack of propaganda or verve. What *is* missing from the debate is any semblance of a theoretical framework within which to analyze the issues and, perhaps more disturbing, a dearth of empirical evidence.[4] We attempt to address these two shortcomings in this paper.

This paper is organized as follows. In Section II, a two-stage, game-theoretic model of switch deployment is presented. This theoretical analysis, though simple, illustrates the difficulty in finding an unambiguous relationship between network access prices and CLEC facilities deployment. In Section III, the empirical model is described and the results summarized. Concluding comments are provided in Section IV.

II. Conceptual Framework

In order to assess the impact of unbundled network element rates on switch deployment, we develop an economic model in the form of a two-stage game. In Stage 1, firms choose whether or not to enter the market. Then, in Stage 2, firms choose how much switching to self-supply. As is customary with two-stage models, the model is solved backwards so that the first decision to evaluate is how a firm selects its optimal investment in switching, S^*, given that it enters in Stage 1. For simplicity, it is assumed that firms are symmetric *ex ante*, but not *ex post*, and that entry does not affect the retail margin.

TELRIC is a forward-looking methodology, where costs are based on the most efficient, currently deployed technology.

[4] Two empirical studies address the impact of the FCC's restriction on unbundled switching in the largest metropolitan statistical areas. See Z-Tel Policy Papers No. 3 (*An Empirical Exploration of the Unbundled Local Switching Restriction*) and No. 4 (*Does Unbundling Really Discourage Facilities-Based Entry? An Econometric Examination of the Unbundled Switching Restriction*). Both papers are available for download at www.z-tel.com, in the investment information section. Neither of these papers addresses, however, the question of facilities-deployment and network access prices.

The model takes the point of view of the CLEC and evaluates the CLEC's decision whether or not to self-provide local switching. In other words, the model assumes that this CLEC entrant decides on its switch investment prior to knowing how many customers it will have (i.e., prior to entry).[5] Thus, there is an uncertainty component to the model, and this uncertainty relates to demand. Upon entering the market, the CLEC provides service to end-users using unbundled loops purchased from the ILEC along with either unbundled local switching purchased from the ILEC or its own, self-supplied local switching.

The variables of the model include:

I = the number of firms that enter;

$N(I)$ = expected number of customers a single firm acquires and serves upon entry;

$\lambda N(I)$ = actual number of customers;

λ = random variable, $E(\lambda) = 1$, $\lambda \in [0, \infty+)$ with probability density function $f(\lambda)$ and cumulative density function $F(\lambda)$;

S = number of customers firm can service with its own switches;

$e \cdot S$ = cost of firm switches (a sunk cost), where e is the price per customer served by self-supplied switching;

P_l = regulated price of an unbundled loop;

P_s = regulated price of unbundled switching;

c = other per customer retail costs;

R = revenue per end-user customer;

M_a = margin with self-supplied switching $(R - P_l - c)$;

M_b = margin with unbundled switching $(R - P_l - P_s - c)$, where $M_a > M_b$.

Prior to entry, firms expect to acquire and serve N customers. However, the customer base is only an expectation, with actual customers equaling λN (where λ is a random variable). If $\lambda N < S$, actual demand is less than switching capacity,

[5] This assumption is rationale, because network design and configuration, staffing requirements, financial and capital requirements, and operational experience vary considerably between CLECs that self-provide local switching capacity.

the entrant uses its own switching exclusively. This level of demand occurs with probability $F(S/N)$.

In this case, the profit of the entrant is

$$\pi = \lambda N \cdot M_0 - e \cdot S\ , \tag{1}$$

which is simply the margin on the actual customer base minus switch investment. Alternately, if $\lambda N > S$, the entrant uses both its own switching *capacity as well as purchasing unbundled switching from the ILEC.* This level of demand occurs with probability $[1 - F(S/N)]$. In this case, the profit of the entrant is

$$\pi = S \cdot M_0 + (\lambda N - S)M_b - e \cdot S\ . \tag{2}$$

Note that there can be other sunk entry costs in addition to switching investment, but the presence of such costs does not alter the analysis. For expositional convenience, we ignore such costs.

Expected profit as a function of S, N, P_l, and P_s is

$$E\pi = \int_0^{S/N} \lambda f(\lambda) d\lambda \cdot N \cdot M_o + \int_{S/N}^{\infty} \lambda f(\lambda) d\lambda \cdot N M_b + (1 - F(S/N)) \cdot S \cdot (M_o - M_b) - e \cdot S\ . \tag{3}$$

To find the optimal level of switch investment, S^*, the first order condition of Equation (3) with respect to S is needed:

$$\frac{\partial E\pi}{\partial S} = (1 - F(S/N)) \cdot (M_o - M_b) - e = 0\ . \tag{4}$$

The second order condition is

$$\frac{\partial E\pi}{\partial S} = -f(S/N) \cdot (1/N) \cdot (M_o - M_b) < 0 \tag{5}$$

indicating that S^* is a maximum.

Useful comparative static results include

$$\frac{\partial^2 E\pi}{\partial S \partial N} = -f(S/N) \cdot \frac{-S}{N^2} (M_o - M_b) > 0\ , \tag{6}$$

indicating that the larger the number of expected customers, the more the entrant will self-supply switching.[6] Defining π at S^* as π^*, we have

$$\frac{\partial E\pi^*}{\partial N} = \int_0^{S/N} \lambda f(\lambda) d\lambda \cdot N \cdot M_o + \int_{S/N}^{\infty} \lambda f(\lambda) d\lambda \cdot N M_b > 0\ , \tag{7}$$

$$\frac{\partial E\pi^*}{\partial P_s} = N\left[(1 - F(S/N)) \cdot S/N - \int_{S/N}^{\infty} \lambda f(\lambda) d\lambda \right] < 0\ , \tag{8}$$

and,

$$\frac{\partial E\pi^*}{\partial P_l} = -N < 0\ . \tag{9}$$

Equation (7) indicates that an increase in the customer base increases expected profits. Equation (8) and Equation (9) imply that higher element rates, whether loops or switching, reduce expected profits.

Turning to the question of switches deployed in the market, assume that all firms pick the same S^* *ex ante*, but *ex post* the demands differ randomly for firms. Market demand is assumed to be constant and insensitive to the allocation of demand among firms. Given R, P_l, P_s, e, and N, each firm selects S^*. Equilibrium profit for each firm, π^*, is assumed to be zero. This assumption allows us to solve for $\check{N}$, the "minimum necessary market size." The number of firms that enter, I, depends on this $\check{N}$ (*i.e.*, $I = I(\check{N})$), where $I' < 0$ – the larger the market share needed to break even, the fewer firms enter in equilibrium. The optimal level of switch deployment for any given firm is $S^* = S^*(P_l, P_s, \check{N})$.

If each firm deploys S^* switching, then the total amount of CLEC switching is given by

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[6] It is plain to see here how the capacity constraints of the manual, hot-cut process will impede CLEC switch deployment.

$$\check{S} = I(\check{N}) \cdot S^*, \tag{10}$$

which states that total switching capacity deployed is simply the number of firms multiplied by average switching capacity. The response of switching deployed to a change in the loop rate is

$$\frac{d\check{S}}{dP_l} = I' \frac{\partial \check{N}}{\partial P_l} \cdot S^* + I\left[\frac{\partial S^*}{\partial P_l} + \frac{\partial S^*}{\partial N}\frac{\partial \check{N}}{\partial P_l}\right] \tag{11}$$

but $dS^*/dP_l = 0$, so

$$\frac{d\check{S}}{dP_l} = \frac{\partial \check{N}}{\partial P_l}\left[I' S^* + I \cdot \frac{\partial S^*}{\partial N}\right]. \tag{12}$$

All the right-hand side terms in Equation (12) are positive except for I'. Thus, the sign on $d\check{S}/dP_l$ is ambiguous. Equation (12) reveals the two important, and contrary, effects of changes in the loop rate on switch deployment. First, as P_l rises, the per-customer margin declines. When customers become less profitable, the entrant needs more customers to breakeven ($d\check{N}/dP_l > 0$), and an increase in customers leads to increased switch deployment. This effect is called the scale effect.

The second effect is called the entry effect. From the scale effect, we know that a change in the loop price alters the scale of the firm. As the market share required to profitably enter rises due an increase in the loop rate, fewer firms can profitably enter ($I' < 0$). A reduction in the number of firms reduces total switch deployment. The source of the ambiguity is, therefore, concerns whether the scale effect dominates the entry effect, or vice versa.

While the scale and entry effects arise when considering the effects of the switching price on total switches, an additional effect is also present. A change in the switching rate on total switches is

$$\frac{d\check{S}}{dP_s} = \frac{\partial \check{N}}{\partial P_s}\left[I' S^* + I \cdot \frac{\partial S^*}{\partial N}\right] + I \cdot \frac{dS^*}{dP_s}. \tag{13}$$

The scale and entry effects are both present, but there is an additional term on the right-hand side not present in Equation (12). This term measures the *substitution effect*. The substitution effect accounts for the substitution between self-supplied switching and purchased switching. As the price of purchased switching declines, the incentive to self-supply switching declines ($dS^*/dP_s > 0$), and vice versa. Clearly, the substitution effect is only one of three potential effects arising from a change in switching rates. The sign of Equation (13), as with Equation (12), is ambiguous. Because the theory offers no unambiguous finding with respect to unbundled switching rates and switch deployment, the impact of changes in the switching rates on switch deployment is an empirical question. It is to that empirical question to which we now turn.

III. Econometric Model

This empirical model focuses on the relationship between CLEC deployed local exchange switching equipment and the rates for unbundled local loops and unbundled local switching. The relationship between element rates and switching facilities deployment is particularly interesting since switch deployment is the primary focus of the ILECs' policy agenda. Furthermore, local switching is fertile ground for empirical analysis because state-level data on CLEC deployment of local switching equipment is available, and because UNE prices are established on a state-by-state basis, providing sufficient variability in the data for econometric analysis. In addition, the FCC has limited the availability of unbundled local switching in certain areas of the Top 50 metropolitan statistical areas. Thus, it is possible to assess how this lack of access has influenced switch deployment.

From the Local Exchange Routing Guide ("LERG"), we compute the number of CLEC switches deployed (S) between April 2000 and October 2001 in each of the fifty states and the District of Columbia. Also computed is the number of CLEC switches deployed between January 1999 and April 2000 ($S99$). Explanatory variables include the price of local loops (P_L), the price of unbundled local switching (P_S), market size as measured by the number of Bell Company access lines in the state (*LINES*), and average local service revenue per-line in the state (*RETAIL*). In addition, the variable *RESTRICT* measures the percent of population in those metropolitan statistical areas in each state where the availability of unbundled local switching is limited.

1. DATA

As previously mentioned, CLEC switch deployment data is provided by the LERG (January 1999, April 2000, and October, 2001).[7] Bell Company access lines by state are provided by ARMIS From 43-04 (2000 data).[8] Retail price is measured as average revenue per line, and this data is provided by the FCC's universal service reports.[9] The percent of population for each state in a restricted, Top 50 MSA is computed using Census data.[10]

Unbundled element rates for loops and unbundled switching are based on state tariffs and interconnection agreements between the ILEC and CLECs. The computation of element costs is both a complex and enormous undertaking. This undertaking was avoided, fortunately, by acquiring summary data on network access prices from a CLEC serving the vast majority of the U.S. market.[11] Loop and switching cost data was provided for 39 states. To protect the confidentiality of the data, the price data is normalized to 1.00 by dividing the series by their respective means. This adjustment to the data has no material impact on the regression results, affecting on the constant term. Because the other explanatory variables are available for all states, these 39 states make up the final sample.

2. RESULTS

The econometric equation describing switch deployment is

$$S = \beta_0 + \beta_1 P_L + \beta_2 P_S + \beta_3 LINES + \beta_4 RETAIL + \beta_5 RESTRICT + \varepsilon \qquad (14)$$

[7] CLEC switches are defined as follows: COC_TYPE = "EOC"; CATEGORY = "CLEC", "I_reseller", or "CAP"; minimum values for NPA and NXX = "Not Null". The CATEGORY field is found in LERG 1, whereas the remaining fields are found in LERG 6. The two tables are linked using the field "OCN."

[8] The ARMIS data is available online at www.fcc.gov/ccb/armis.

[9] Federal Communications Commission, State-by-State Telephone Revenues and Universal Service Data, April 2001, Table 5.

[10] For MSAs that cross state lines, the population is allocated in proportion to the largest cities within the MSA. Because the FCC's switching restriction did not apply in New York and Texas, *RESTRICT* was set equal to zero for these states.

[11] The data was provided by Z-Tel Communications, in Tampa, Florida. Z-Tel provides local exchange service using the UNE-Platform (local loops plus local switching/transport) in ___ states. Switching costs include local switching and transport, as well as switch related charges such as the daily usage file (usage statistics required for billing).

where the βs are the estimated coefficients and ε is the econometric disturbance term. The dependent variable (S) is count data (i.e., the data has only discrete, so we employ the Negative Binomial Regression, which a commonly used alternative to linear least squares regression for count data. [12] Unlike the Poisson regression, which is another popular regression technique for count data, the negative binomial regression does not require that the conditional mean of the data equal the conditional variance. If this assumption is incorrect (i.e., there is *overdispersion* in the data), then the Poisson estimates are invalid. The estimates of the Negative Binomial Regression, however, are not. Further, if overdispersion is not present, then the estimates of the Negative Binomial Regression are identical to those of the Poisson regression.

As a product of the Negative Binomial Regression, and "overdispersion" parameter, α, is estimated. The value and statistical significance of this estimated parameter indicates whether or not the Negative Binomial regression is preferred to the Poisson regression, because a non-zero value of the overdispersion parameter indicates the restrictive assumptions of the Poisson regression are inappropriate. If the estimated overdispersion parameter is zero (statistically insignificant), then the Negative Binomial regression is identical to the Poisson regression. Our estimates indicate that overdispersion is present in the data, so the Negative Binomial Regression is the preferred estimation technique for Equation (14).

The results of the Negative Binomial Regression are provided in Table 1.[13] Two models are estimated. In Model (1), the dependent variable is measured as the number of CLEC switches deployed in each state between April 2000 and October 2001, during which time the restriction on access to unbundled switching applied.[14] Model (2) has a dependent variable measuring the number of CLEC switches deployed between January 1999 and April 2000, a period prior to the ULS restriction. This second model is estimated primarily to validate the specification of *RESTRICT*. If our measure of the switching restriction is statistically significant during a period in which the restriction did not apply, it is

[12] For a technical discussion of Negative Binomial and Poisson regressions, see A. Colin Cameron and Pravin K. Trivedi, *Regression Analysis of Count Data* (1998), Ch. 3.

[13] Both models were estimated using ordinary least squares. The results were not materially affected, though the estimates of the Negative Binomial Regression were more efficient. For the OLS regressions, the Ramsey RESET Test of "no specification error" could not be rejected for either equation.

[14] The restriction continues to apply.

possible that *RESTRICT* also is measuring factors other than the switching restriction.

The likelihood ratio index, a measure of goodness-of-fit, is just above 0.74 for both models.[15] The overdispersion parameter, α, is statistically significant for both models, indicating that the Negative Binomial Regression is preferred to the Poisson regression.

For Model (1), all explanatory variables are statistically significant at the 5% level or better. As expected, larger markets have more CLEC switch entry; the coefficient on *LINES* is positive and highly statistically significant ($t = 3.60$). Note that the relationship between access lines and CLEC switches is less than proportional indicating that a 10% increase in lines results in only a 5% increase in switch deployment.[16] Higher revenue per access line also leads to more switch deployment (*RETAIL* is statistically significant and positive). The positive (and nearly statistically significant) sign on *RETAIL* was expected somewhat because higher expected revenues increase the expected profit of entry (ceteris paribus).[17]

Of particular interest are the effects of UNE rates (P_L, P_S) and the unbundled switching restriction (*RESTRICT*) on CLEC switch deployment. No a priori expectation regarding the effect of the price for unbundled loops or switching on switch deployment was made, given that the theoretical model allows for both positive and negative values (and perhaps a zero value). The regression results indicate, however, that higher loop rates decrease switch deployment; a negative and statistically significant sign on P_L is estimated (with t-statistic 2.64). The empirical model, by the negative sign on P_L, indicates that the entry effect dominates the scale effect. We cannot reject that the estimated coefficient on P_L (-0.95) is equal to –1.00 (via the Wald Test). Thus, assuming a unitary elasticity between switch deployment and loop price is reasonable (i.e., a 10% increase in the loop rate decreases CLEC switch deployment by about 10%).

The theoretical ambiguity between the price for unbundled switching and switch deployment is resolved by the empirical model. The estimated coefficient on the price of local switching (P_S) is negative and statistically significant (the t-statistic is 2.18). The estimated coefficient indicates an elasticity of -0.50, so a 10% increase in the ULS rate decreases CLEC switch deployment by 5%. The negative coefficient indicates that, on average, the substitution of unbundled switching for switch deployment is not the dominant factor at current UNE rates. The entry effect dominates both the scale and substitution effects. Higher switching rates reduce CLEC switch deployment, on average.

Finally, the sign on *RESTRICT* is negative and statistically significant (the t-statistics is 1.96), indicating that the restriction has impeded rather than encouraged switch deployment. At the sample means for the other variables, the elimination of the switching restriction in states where the restriction applies would increase CLEC switching capacity by 44% in those states, on average.[18] These regression results suggest that the switching restriction has been a major policy failure, significantly deterring switch deployment.[19]

We recognize that given the specification of *RESTRICT*, there is the potential that the variable captures variations in switch deployment across states based factors other than the switching restriction. However, *RESTRICT* has no effect on switch deployment between January 1999 and April 2000 (Model 2), the period prior to the implementation of the restriction. Because the percent of population in a restricted, Top 50 MSA has no effect prior to the implementation of the restriction, but a negative and statistically significant effect after the restriction, it is reasonable to conclude that the regression properly captures the effect of the restriction. Only market size (*LINES*) and the constant term are statistically significant in Model 2.

IV. Conclusion

Profit maximizing firms participating in a market economy make "make-or-buy" decisions everyday. While these decisions are of interest to economists in determining what may be an efficient organization of the firm, the "make-or-buy" decision is evaluated differently when the ability to "buy" is mandated and governed by regulation rather than the market, and the ability to "make" is limited substantially by various entry barriers. Such scenarios are commonplace

[15] For a discussion of goodness-of-fit measures for non-linear regressions, see Cameron and Trivedi, pp. 151-8.

[16] A consistent result is found in *Does Unbundling Really Discourage Facilities-Based Entry? An Econometric Examination of the Unbundled Switching Restriction*, Z-Tel Policy Paper No. 4 (February 2002).

[17] However, existing retail prices may not be a reliable estimate of post-entry prices, so such prices may be ignored by entrants.

[18] The mean of *RESTRICT* for states where the restriction applies is 46%.

[19] Earlier econometric research on the switching restriction indicates that the overall level of CLEC penetration is reduced by the switching restriction. See *An Empirical Exploration of the Unbundled Local Switching Restriction*, Z-Tel Policy Paper No. 3 (Updated February 2002).

in the competition policy for the regulated utilities including electricity, gas, and telecommunications.

One common concern in such scenarios is when the ability to "buy" substantially offsets the incentive to "make." In this paper, we evaluated both theoretically and empirically the relationship between "make" and "buy." In our particular construct, where self-supplied and purchased inputs may serve as complements, three sometimes conflicting effects are relevant to the "make-or-buy" decision, of which the substitution effect is only one. Our empirical example considers the deployment of switching facilities by entrants to the local exchange telecommunications markets, and these empirics indicate that the substitution effect is not dominant in this particular case. Of course, the empirical example chosen for our analysis is not necessarily indicative of any other particular case. However, our findings do support the general notion that the substitution effect is not the only relevant consideration, either theoretical or empirical, for policy makers in selecting what inputs to make available to entrants when promoting competition in the utility industries.

References:

Cameron, A.C., and P.K. Trivedi. *Regression Analysis of Count Data*, 1998, Cambridge University Press, Cambridge.

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Table 1. Negative Binomial Regression Results and Descriptive Statistics

(N = 39)

Variable	Dependent Variable = *S* Coefficient (t-Stat)	Dependent Variable = *S99* Coefficient (t-Stat)	Mean (St. Dev)
Constant	-10.169 (-3.60)[a]	-9.598 (-4.19)[a]	...
ln(*LOOP*)	-0.953 (-2.64)[a]	0.387 (1.22)	1.00 0.29
ln(*ULS*)	-0.487 (-2.18)[a]	-0.006 (-0.03)	1.00 0.49
ln(*LINES*)	0.490 (3.68)[a]	0.753 (6.93)[a]	3,744,347 (4,157,467)
ln(*ARPL*)	1.917 (2.59)[a]	0.568 (0.93)	33.95 (4.70)
RESTRICT	-0.798 (-1.96)[a]	0.010 (0.03)	0.30 (0.28)
α	0.268 (5.43)[a]	0.178 (6.46)[a]	...
Pseudo R^2	0.76[c]	0.74[c]	
S			46.72 (41.59)
S99			39.31 (35.34)

[a] Statistically Significant at the 5% level or better.
[b] Statistically Significant at the 10% level or better.
[c] Pseudo-R2 is computed using the likelihood ratio index.